DEVELOPMENT, ESTIMATION, AND FORECASTING ACCURACY OF REGIONAL FINANCIAL MODELS: AN APPLICATION WITHIN THE STATE OF FLORIDA

by

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A review of the state of the art in regional econometric model building leads to the conclusion that current models identify only weak links between financial and real activity. As a consequence, the predictive performance of regional models in the investment and construction sectors is less than satisfactory and far inferior to the performance of national models, where financial variables have been shown to hold the key to the explanation of short-run cyclical swings.

A test of the hypothesis that the transmission of monetary impulses is uniform across the United States and not modified by spatial effects involves the development and estimation of deposit flow and financial intermediary asset-demand equations for six sample states with widely differing economic and demographic characteristics. Significant regional differences in the interest sensitivity of depositors are found resulting in corresponding regional differences in deposit flows. Since the estimation results for local financial intermediary portfolio behavior indicate that relative deposit flows are the main determinants of asset-demand, it is concluded that disaggregated financial variables should be included in regional econometric models.

The developed concepts are applied to an econometric model of the Florida economy in which regional financial variables are specified as determinants of residential construction. Dynamic simulations of the simultaneous equation model show that state deposit flows and mortgage market activity can be forecasted with high accuracy. The solution values for residential construction track the actual data series very closely, and it is concluded that the inclusion of a regional financial sector improves the performance of the whole model and helps to bridge existing gaps in the regional data base.

CHAPTER 1

INTRODUCTION AND OVERVIEW

Despite the fact that financial variables play a key role in explaining short-run swings in construction and investment activity in national econometric models, most regional model builders have either entirely ignored monetary and financial variables or they have included only national financial variables in their models. The models typically follow the general form that Klein (1969) suggested for subnational econometric models, i.e. they are "driven" by national variables such as gross national product, federal government expenditures, interest rates, and prices which are in turn predicted by national models.

Klein's approach is based on the assumption that the national money market presents a uniform cost of funds to all regions. It is typically argued that the existing interest rate differentials among U.S. regions are quite small and consistent with equilibrium because they offset both the small cost of transferring funds and the slight differentials in the risk level among regions.

Some model builders, recognizing the importance of non-interest-rate rationing effects, have used various proxies for a credit rationing variable. Since the proxies are constructed from national variables, the underlying assumption appears to be that credit rationing effects are also uniform across the United States.

This specification (or misspecification) of regional models has invariably resulted in large forecasting errors in the construction and investment sectors, and a forecasting performance that is clearly inferior to national models. In addition, the rudimentary treatment of the financial sector severely restricted the usefulness of these models for policy analysis.

Focusing on the set of linkages between savings and loan and commercial bank deposits, mortgages, and residential construction, this study attempts to show that the financial structure of a region is crucial to the way monetary policy affects a region's real activity and that the inclusion of a regional financial sector can substantially improve the link from financial to real for analytic and forecasting purposes.

The study is organized as follows:

The literature on the channels of monetary policy is first surveyed in chapter 2. This is followed by an examination of the empirical specification of the channels of monetary policy in national econometric models. The chapter concludes with a review of the state of the art in regional econometric model building. Particular attention is devoted to the theoretical and empirical specification of the links between financial and real activity in current models. In the process, ways to improve this specification are suggested.

Chapter 3 contains a theoretical analysis of the structure of the U.S. capital markets, with special emphasis on the factors that may cause or prevent regional compartmentalization. Theoretical models of household liquid asset demand and of the portfolio behavior of financial intermediaries are developed with the pertinent institutional aspects discussed in some detail.

In chapter 4, the estimation results for the models developed in chapter 3 are analyzed for a sample of six states with widely differing economic and demographic characteristics. This exercise illustrates the extent of regional differences in the structure of household deposit flow demand and the portfolio behavior of financial intermediaries.

In chapter 5 the concepts developed in chapters 2 and 3 are applied to the state of Florida by estimating a complete simultaneous equation model of deposit flows, the mortgage market, and residential construction. The estimation and dynamic simulations results permit an evaluation of the dynamic properties of the model and its predictive performance compared to similar national and regional studies. The chapter concludes with an analysis of the costs and benefits of incorporating a financial sector into a regional econometric model.

CHAPTER 2

MONETARY VARIABLES IN REGIONAL ECONOMETRIC MODELS

2.1 The Channels of Monetary Policy: A Theoretical Analysis

While there remains much disagreement among economists about how total spending and its components react to monetary actions, three channels of monetary influence have become generally recognized: changes in relative prices, changes in nonprice credit rationing, and changes in wealth. In fact, it appears that much of today's controversy centers around the empirical significance of these factors in the transmission of monetary impulses. A vivid picture of the current state of the debate is provided in Gordon (1974).

In this section, each of these channels is described and their relative importance within an econometric model is indicated. The following section explains how the channels of monetary policy are specified in certain national models. Subsequent sections in this chapter are devoted to an investigation of the same problem for regional econometric models and ways to improve the specification of such models.

The relative price channel plays a prominent role in the current models of short-run financial-real interactions. The reason is that all such models are based on a theory of portfolio optimization where wealth holders continously strive to equate the marginal rates of return (adjusted for risk) on all their assets. A monetary policy action may produce a temporary disequilibrium because of a change in the aggregate supply of an asset -- short-term Government securities, for example -- which results in a reduction of the relative price of that asset. This change in asset yields is followed by a whole chain of substitution effects until a new equilibrium is reached. Spencer (1974) argues that one of the main differences between the models of such economists as Tobin, Brunner and Meltzer, and Friedman lies in the number of assets they include in their portfolio models and, consequently, the substitutability assumptions they use. This, however, determines the relative price channels of monetary influence. At a minimum, therefore, an econometric model must specify a money-interest rates channel and an interest rates-investment channel since all of the theoretical models allow for this channel. In addition, the specification of the transmission mechanism may include consumer durables as well as consumer nondurable goods and services (Friedman 1974).

An underlying assumption of the relative price effect is that markets are perfect in the sense that they are cleared rapidly by price movements. If there are lags in the price adjustment, the influence transmitted through the relative price channel will be felt more gradually and a new channel, capturing nonprice rationing effects, should be specified. There is a large body of literature dealing with the rationality and empirical significance of credit rationing. The general conclusion is that credit rationing is in fact compatible with rational bank behavior and its empirical significance has been established for the supply of commercial loans and in the market for mortgage funds (Jaffee and Modigliani 1969, Harris 1974, de Leeuw and Gramlich 1969).

Since credit rationing cannot be measured directly, a proxy variable has to be used to measure its effect. Indeed, the appropriateness of a particular proxy variable is the main problem in the specification of the credit rationing channel. On theoretical grounds, there are as many nonprice rationing linkages as there are relative price effects but as indicated above, only two links -- through commercial loans and mortgage loans -- have been quantified.

The third channel of monetary influence operates through changes in wealth, where the linkage is between wealth and consumption. Real consumption is assumed to be a function of real human wealth, a concept related to permanent income, and of nonhuman money wealth. Only nonhuman money wealth is directly affected by monetary actions and the so-called wealth effect refers only to changes in nonhuman wealth or net worth. Aggregate nonhuman wealth is typically defined to consist of the money stock, the market value of outstanding government debt and the market value of equity (Tobin 1969, Ando and Modigliani 1972). This is a relatively narrow definition of net worth, since it does not include such items as net indebtedness of corporations to individuals, the value of residential structures and land directly owned by individuals; and the stock of consumer durables owned by individuals. Data problems with these items make it impractical, however, to include them in a definition of net worth which is used in empirical work. Equities are estimated to represent about one third of the broadly defined net worth (Ando and Modigliani 1972).

The money stock component can affect wealth in two ways. First, an increase in the money stock not immediately followed by a proportionate change in the price level increases wealth. The second effect, known as the real balance effect or Pigou effect, has been widely discussed in the literature (Bailey 1971). An increase in wealth is brought about not by increasing the money stock, but by a falling price level with an unchanged money stock. The empirical significance of the Pigou effect as well as of the effect of changes in the market value of outstanding government debt have not been clearly demonstrated. Even if they exert some influence on consumer spending, their effect appears to be swamped by the equity effect which arises because monetary growth and the market valuation of equities are positively related, at least in the short-run (Meiselman and Simpson 1971). The line of causation runs from Federal Reserve open market purchases of Government securities to lower yields on these bonds to a reshuffling of portfolios which eventually results in higher equity prices. The capital gain on these equities accruing to the stockholders leads to the monetary induced wealth effects on consumption.

2.2 The Empirical Specification of the Channels of Monetary Policy in National Econometric Models

In this section, the empirical specification of the channels of monetary policy in the Federal Reserve - MIT econometric model (currently called MPS model) will be described as well as the specification of MINNIE, a recently developed reduced version of the MPS model.

Since the MPS model was constructed "to produce a structural model which emphazised the role of policy instruments"(Cooper 1974, p.8), the linkages between financial variables and real economic activity are spelled out in considerably more detail than in most other national models. Therefore, other models will only be discussed to the extent that their approach is basically different from the MPS approach.

Three channels of monetary policy were identified and incorporated into the earliest version of the MPS model: The cost of capital, affecting single- and multifamily housing, plant and equipment, state and local construction, and investment in consumer durable goods; capital gains, affecting consumption; and credit rationing, affecting the housing sector (de Leeuw and Gramlich 1969).

The importance of the cost of capital derives from the fact, that it is seen as the main determinant of the required rate of return on an investment. The same basic cost of capital formula which expresses the gross rate of return on a capital good as a function of its depreciation, an appropriate rate of interest, tax rates, and expected capital gains is used in the above mentioned four categories of final demand. The cost of capital variables employed in the residential construction sector are the mortgage rate and the corporate bond rate, a weighted average of which serves to derive the implicit equilibrium asset price for houses. For plant and equipment investment, an estimated linear relation of the industrial bond rate and the dividend-price ratio on common stock is used to derive the implicit quasi-rent for structures and the implicit rent for new equipment, respectively.

The theory behind the wealth channel in the MPS model is that equities are substitutes for bonds, and that therefore changes in the bond rate change the rate at which the stock market capitalizes dividend payments. Dividend payments are expressed as a function of current and lagged corporate cash flows, and the dividend-price ratio is a function of the corporate bond rate and an expected rate of change of prices (estimated as a long distributed lag on past rates of change of consumer prices).

The credit rationing channel was found important only in the housing sector. The argument is that nonprice rationing for new mortgages at savings institutions occurs because of a combination of volatile deposits, fixed-commitment mortgages, and sluggish mortgage rates which increases the risk exposure of savings institutions in times of rising market interest rates. The proxy used for a credit rationing variable is the ratio of actual deposit flows to expected deposit flows. Expected deposit flows are estimated as a growth adjusted average over the preceding three years.

Recent publications on the MPS model (Gramlich and Jaffee 1972, Cooper 1974, Battenberg et al. 1975) show that in the current version of the model, expenditure equations of the model depend on real interest rates. In addition, financial flows including time and savings deposits and mortgage stocks and flows are described in much more detail. With the exception of the housing sector, however, there has been no major change in the specification of the channels of monetary policy.

In the housing sector, the credit availability proxy is now specified as the rate of change in outstanding mortgage commitments of savings and loan associations combined with the rate of change in the stock of mortgages held by the Federal National Mortgage Association (FNMA). The commitment variable is intended to reflect three factors: the availability of permanent financing; the insitutional requirement that construction firms obtain permanent financing commitments prior to obtaining construction loans; and the importance of savings and loans in the home financing business. FNMA is included because of its increased activity in the mortgage market since the late '60s.

Battenberg _et al_. (1975) recently reported on MINNIE, a condensed version of the MPS econometric model. The objective of their research appears to have been to develop a model that would be much less complex than the MPS model but still useful for analytic and forecasting purposes. Many key structural equations and individual parameters are retained from the MPS model, but in terms of stochastic coefficients and equations, MINNIE is only about a third the size of the large model. The same three channels of monetary policy as in the MPS model are specified, but the credit rationing variable in the more aggregated housing sector is defined in a completely different way. Since there are no time deposit and mortgage sectors in MINNIE, the ratio of the Treasury bill rate to the ceiling rate on commercial bank time deposits is used as a credit rationing variable. Furthermore, the lack of a mortgage sector makes it necessary to replace the mortgage rate by the corporate bond rate as the cost of capital variable in the housing sector. The authors claim, however, that even with these differences the short-run dynamic responses of MINNIE are quite close to those of the MPS model.

Two national models whose specification of the channels of monetary policy differs somewhat from the MPS approach are the Wharton model and the Data Resources (DRI) model.

The only difference of interest between the Wharton model and the MPS model can be found in the housing investment equation, where the Wharton model uses an interest spread variable (the difference between the long-term and short-term interest rates) as a credit availability proxy (Haitovsky et al. 1974).

The structure of the DRI model allows for all three channels of monetary policy (Eckstein et al. 1974). The specifications of the wealth channel and of the cost of capital channel are very similar to the corresponding links in the MPS model. A minor difference arises because the key short-term interest rate in the MPS model is the commercial paper rate, whereas the Treasury bill rate plays this role in the DRI model. The credit rationing channel in the DRI model is also limited to the housing sector, but its specification is more elaborate. In particular, credit availability effects are captured in the supply of mortgages by savings and loan associations (S&Ls), mutual savings banks (MSBs), life insurance companies (LICs), and commercial banks. An additional credit rationing variable is mortgage commitments at S&Ls, MSBs, and LICs. This variable is also affected by new mortgage commitments by the Federal Home Loan Mortgage Corporation.

2.3 The Specification of the Channels of Monetary Policy in Regional Econometric Models

In a recent study of the regional impact of monetary policy, Fishkind (1975) provides an in depth analysis of the current state of the art in regional econometric model building. Among his main findings are: Very few regional models allow for any kind of links between financial and real economic activity, and none of them specifies a complete set of linkages. As has to be expected, the ensuing specification errors result in a poor forecasting performance of these models, especially in the construction and investment sector. The general conclusion, therefore, is that the usefulness of the existing regional models for policy analysis as well as their forecasting accuracy is greatly reduced by the fact that they are not firmly grounded in accepted economic theory. In order to improve on this situation, Fishkind develops a regional model that for the first time allows for all of the three channels of monetary policy discussed in section 2.1. Since his model incorporates the previous research in this field, it provides a convenient vehicle for my analysis of the specification of the monetary transmission mechanism in regional econometric models. (In this section, all page references refer to Fishkind (1975).)

Fishkind is the first to attempt to incorporate the wealth channel into a regional model. He does it by assuming that - in analogy to Friedman's (1957) permanent income hypothesis - the output of the region's nonbasic sector is a function of regional permanent income or wealth (p.95).

Regional permanent income is expressed as a geometrically lagged function of regional disposable income. After a Koyck transformation, nonbasic output becomes a function of current disposable personal income and nonbasic output lagged one period. However, it should be noted that Fishkind's claim to have specified a wealth channel is not warranted. The transformed equation (p.95) is stated as

$$(2) \quad QNB_t = f(SDPI_t, QNB_{t-1})$$

where: QNB = output of the nonbasic sector;
SDPI = regional disposable personal income.

Since neither $SDPI_t$ nor QNB_{t-1} are directly affected by monetary policy, there is clearly no direct link between QNB_t and monetary policy. This is consistent, of course, with the discussion of the wealth channel in section 2.1. The concept of permanent income is much more closely related to human wealth than to nonhuman wealth, or net worth, on which the wealth effect is based. In fact, Friedman (1974) does not attach any particular importance to this channel in the monetarist framework. This contrasts with the work of Ando and Modigliani (1972) which provides the underlying theory for much of the MPS model where capital gains play an important role. Since Fishkind (pp. 4, 102) bases his arguments on the key article by de Leeuw and Gramlich (1969) in which they describe the channels of monetary policy in the MPS model, he borrows from two different schools of thought (Friedman vs. Modigliani et al.), apparently overlooking the fact that their respective definitions of wealth are not compatible in a discussion of the channels of monetary policy.

The second channel is the cost of capital channel. The cost of capital appears in Fishkind's model in three equations (pp. 94, 96, 106).

$$(1) \quad QB_t = f\,(GNP^*_t, YCB^*_t)$$

where: QB = basic sector output;
GNP^* = gross national product (exogenous);
YCB^* = corporate bond yield (exogenous).

The equation is based on the export base hypothesis. GNP serves as a proxy for external demand and YCB is assumed to influence demand because this region's exports consist mainly of durable goods. The estimated coefficient of YCB is negative, as expected, and highly significant. Equation (1) represents a theoretically sound specification of a cost of capital channel which can be given empirical content.

The theoretical interpretation of the following equation is more difficult.

(8) $PROP_t = f\ (GSP_t,\ YCB_t^*)$

where: PROP = proprietor's income;

GSP = gross regional product;

YCB* = corporate bond yield (exogenous).

The estimated equation also includes a time variable. The bond yield is included to capture the effects of interest income. Since there is no scale variable associated with the interest rate, its coefficient cannot be interpreted in an economically meaningful way. Also, it must be assumed that dividend and interest income are affected in the same way by changing interest rates. I feel, that this is a rather weak link although the equation fits quite well. An alternative specification is provided in Adams et al. (1975),where

$PROP_t$ = f (Dividends + rent and interest income U.S.)

This equation explains 99.7 percent of the variation in Mississippi's property income.

Finally, investment in plant is specified as

$$(27)\quad INRP_t = f\ (\%DGSP_t,\ YCB^*_t,\ SITR^*_t)$$

where: INRP = nonresidential investment in plant;

%DGSP = percentage change in gross regional product;

YCB* = corporate bond yield (exogenous);

SITR* = state's effective tax rate (exogenous).

%DGSP is supposed to capture domestic expectations. The cost of capital and the tax rate are both expected to have a depressing effect on investment. As it turns out, the estimated coefficient of YCB* is positive and highly significant (t-value of 7.98). The specification of equation (27) is not changed, however, and the coefficient with the perverse sign is retained for policy simulation purposes. This is somewhat surprising, given that an inverse relationship between the interest rate and investment really forms the core of the cost of capital theory.

The last channel of monetary policy provided for is the credit availability channel.

$$(26) \quad IRH_t = f\,(SDPI_t,\ IRH_{t-1},\ YCB^*_t - YPB^*_t,\ M^*_t)$$

where: IRH = value of new residential construction put in place;

SDPI = regional disposable personal income;

YCB* = corporate bond yield (exogenous);

YPB* = effective yield on savings deposits at regional savings and loan associations (exogenous?);

M* = FHA new mortgage yield.

Equation (26) appears to allow for all the three channels of monetary policy. Residential construction is viewed as a negative function of the cost of capital, M, and as a positive function of "wealth" (permanent income), where the wealth effect is supposed to be captured by $SDPI_t$ and IRH_{t-1} just as in the above discussed equation (2). Equation (26) is seriously misspecified, however, since a Koyck transformation of an equation with several explanatory variables affects the dependent variable and all the regressors. In particular, retaining Fishkind's concept of permanent income, equation (26) should also include the lagged value of the credit rationing variable and M^*_{t-1}.

The third channel is provided by (YCB* - YPB*), a credit rationing proxy. As discussed in sections 2.1 and 2.2, credit rationing effects are significant in the housing market. This justifies the inclusion of a credit rationing variable in equation (26). Two caveats are in order, however. First, nonprice credit rationing is a short-run phenomenon and is therefore usually only incorporated into models using quarterly or monthly data (Kearl et al. 1975, Fair 1973, Swan 1972a). In fact, Swan (1973) points out that annual data do not reveal the housing slump of 1969 and 1970, for example. On an annual basis, total private starts were 1.467 in 1969 and 1.434 million units in 1970. Looking at quarterly data, one finds that starts fell from an annual rate of 1.629 in late 1968 to 1.265 million in early 1970, a decline of over 22 percent. The second problem with the credit rationing variable is the choice of the two interest rates. Clearly, the rationale for using an interest rate spread is the observed occurrance of disintermediation when savings accounts are in competition with high yielding market instruments (a detailed discussion of disintermediation follows in chapter 3). Disintermediation, in turn, is supposed to reduce the availability of mortgage funds and thus to exert an adverse influence on residential investment. YPB, the interest rate offered by regional savings and loan associations, appears to be the appropriate "own" yield. Fishkind's justification for its inclusion is that "local credit market conditions become most important when the availability of capital for financing mortgages is restricted" (p. 103). This argument is clearly inconsistent, however, with one of the key assumptions he makes at the outset of the study, namely, that capital is perfectly mobile in the United States (p. 1). In fact, the whole notion of credit availability is based on the existence of market imperfections.

There are still other problems with this credit rationing variable. How can the yield on regional savings accounts be exogenous to this model? Further, it is not clear how the model can be used for forecasting. The competing yield is YCB, the yield on corporate bonds, allegedly because "it is well established that if the yield on corporate bonds (our surrogate for the general class of assets which compete with savings and loan shares for investment funds) rises greatly above the yield offered by savings and loan accounts, financial disintermediation results" (p. 104). This contention is not substantiated and contradicts other evidence in the literature. Time deposits at commercial and mutual savings banks and short-term market instruments are shown to be close substitutes for deposits at savings and loan associations in large-scale national models (Eckstein _et al_. 1974, Gramlich and Hulett 1972). The same view is expressed in studies of the mortgage market (Lessard and Modigliani 1975, Slovin and Sushka 1975) although it was found that deposits at savings and loan associations were more responsive to long-term rates than to short-term rates in the fifties but that "the situation changed drastically" around 1962 (Modigliani 1972, p. 80). Since the credit rationing proxy YCB - YTB is frought with so many problems, the estimation result can be anticipated. The estimated coefficient is negative but insignificant with a t-value of 0.28.

Finally, a comment is warranted about the dynamic simulation of the model within the sample period, its post-sample prediction performance, and the tests of the model's stability and reasonableness of its response to changes in the exogenous variables.

An examination of the dynamic simulation results of the four variables that are expressed as a direct function of monetary variables is facilitated by the fact that Fishkind provides plots of the actual and solution values for all variables. In addition, he has calculated the mean absolute percentage error (MAPE). This measure of the accuracy of the solutions is defined as

$$\text{MAPE} = \frac{1}{T} \sum_{t=1}^{T} \frac{\text{abs}\ (P_t - A_t)}{A_t}$$

where: P = predicted (solved) value;

A = actual value;

T = number of observations; and

abs = absolute value.

Since MAPE is unit free, it allows comparison across variables.

The solution of QB (basic sector output) tracks the actual values during the sample period 1960-1973 rather well although it misses three of the five turning points completely and just barely indicates the fourth. MAPE for this variable is 3.4 percent.

PROP (proprieter's income) tracks the steadily growing actual values very well with a MAPE of 1.4 percent.

The actual values of INRP (nonresidential investment in plant) fluctuate widely. The solution misses all of the five turning points and MAPE is 14.4 percent.

The actual series of IRH (residential construction) is also characterized by wide swings but the solution plots as a steady growth path. MAPE is 15 percent.

The misspecifications of equation (26) and equation (27) clearly exacted their toll.

The post-sample prediction performance can be dealt with quickly. Only six out of the 34 endogenous variables were forecasted. None of the four variables of interest is among them, however, which may explain why the problem with the regional variable YPB (S&L yield) was not discovered.

Fishkind subjects the model to a large number of stability tests by running dynamic simulations after having changed some of the exogenous variables from their actual values. He states that "the differences between the control run and the disturbed simulation run represent the impacts of the changes in the exogenous variables, and these impacts can be viewed as multipliers" (p. 157). The exogenous variables chosen are the yield on corporate bonds and GNP. That is, the effects of a sustained one percent increase in the yield on corporate bonds and of a five billion dollar increase in GNP are simulated. Since both simulations very quickly produce unreasonable results and the whole model is destabilized within just two periods in the first case, Fishkind concludes that the "model is not useful for analyzing long term policies or trends" (p. 160). Such a conclusion is not warranted on the basis of the two tests, however. First, what is the economic interpretation of a 1 percent sustained increase in the corporate bond yield? Is the bond rate viewed as a policy-determined variable? The same questions apply to the five billion dollar increase in GNP. Or, along the same lines, is the calculation of multipliers meaningful?

The problem seems to be that the shocks should be applied to the national model which drives the regional model. Clearly, the two variables chosen are not exogenous to the national model and one is never tempted to use them for stability tests or policy analyses. Bank reserves or the treasury bill rate or the money stock may be used to simulate monetary disturbances. Autonomous shifts in consumption or investment or changes in such policy variables as tax rates or government expenditures would be candidates for real disturbances. This points out another important problem that must not be overlooked. If a regional model is driven by a national model and if one wants to simulate the effect of a change in national variables, the shock must be applied to the national model first. Then, the solution values can be plugged into the subnational model and this will represent an appropriate test. Alternatively, one can shock the regional model directly by changing regional exogenous variables, such as state tax rates and so on.

2.4 Ways to Improve the Specification of Regional Models

The analysis of the state of the art in regional econometric model building in the preceding section shows clearly that regional econometric models have failed to fully incorporate the details of financial-real interactions. In fact, none of the existing models allows for a wealth channel and Fishkind's (1975) attempt to specify a credit rationing channel was unsuccessful. Consequently, the forecasting performance of regional econometric models in the investment and construction sectors is still highly inferior to the performance of large-scale national macro-econometric models where financial variables hold the key to the explanation of the short-run dynamics of economic activity. The rudimentary treatment of financial variables in regional econometric models not only adversely affects their forecasting accuracy, but it also greatly impairs their usefulness for policy analysis.

It appears that there are two principal reasons why monetary forces have not been adequately incorporated into regional econometric models. First, the regional data base is very incomplete, and until very recently consistent time series data were only available on an annual basis. Many monetary phenomena are short-run in nature, however, and could therefore not be satisfactorily captured with annual data.

The second reason for the rather primitive links between the financial and real sectors in regional models has to do with the fact that all regional econometric models are based on the assumption of perfect capital mobility (Glickman 1973, Fishkind 1975). This approach was originally suggested by Klein (1969) at a time when only very few regional econometric models had been constructed, and although Klein himself viewed it only as a first approximation its empirical appropriateness was never seriously questioned. Klein recognized the importance of distance and regional structure phenomena but chose to base his strategy "on the supposition that general cyclical differentials are more important and easier to deal with than are distance differentials" (Klein 1969, p. 115).

Instead of trying to improve the specification of regional models simply by improving on the specification of the recognized channels of monetary policy, I will examine first the question whether the transmission of monetary impulses is in fact uniform across the country or whether it is modified in any way by spatial effects. If distance and regional structure can be shown to be important in financial markets, a significant step forward can be made by incorporating financial variables into regional econometric models at the appropriate level of disaggregation.

CHAPTER 3

REGIONAL COMPARTMENTALIZATION OF CAPITAL MARKETS: A THEORETICAL ANALYSIS

3.1 Introduction

Most regional economic research is based on the assumption of a "perfect" U.S. capital market. That is, it is assumed that transportation costs are negligible, information about sources of capital and investment opportunities is essentially free and available to everyone, and the market is characterized by perfect competition. Under these conditions, capital will flow freely from regions of low return to regions of high return and this results in an equilibrium in which regional rates of return to capital are equal. In this market, for investments in the same risk class and with the same maturity structure, there is only one rate of return, the national rate, and this rate is a market clearing rate.

This efficient allocation of resources through the capital market is supposed to be enhanced by financial intermediaries that transform the funds of relatively small depositors into the financing of real investment. They are able to exploit economies of scale in both the borrowing and lending of financial assets.

In this chapter the validity of the assumption that capital is perfectly mobile will be examined. In particular, I will investigate whether the major financial intermediaries can be expected to quickly respond to regional differences in demand and supply of loanable funds in the given institutional setting. Failure to do so would be indicated either by temporary or permanent regional differences in risk adjusted interest rates in certain segments of the market or by regional variations in non-price credit rationing. Since this latter imperfection cannot be observed directly, it must be inferred from the behavioral response of the various intermediaries to changing credit conditions. The purpose of this chapter, therefore, is to develop a model that can be used to test the hypothesis of capital market compartmentalization. The empirical tests of the significance of regional imperfections will be presented in the next chapter.

Since the general focus of this study is on the linkages between financial activity and residential construction, the investigation will concentrate on spatial effects on the flow of mortgage funds. The framework developed will be general enough, however, to be applied to other segments of the market where imperfections are suspected.

3.2 Market Segmentation: The Regional Dimension

The point of departure for an analysis of possible capital market imperfections is the recognition that the term capital market includes a whole set of closely related markets. In fact, an important distinguishing feature of financial models is their degree of disaggregation, that is, the extent to which financial models explicitely deal with supply and demand for specific types of financial instruments and how they depict the interactions throughout the security markets. Some of the large-scale national econometric models, for example, do not identify separate supply and demand equations for a wide range of financial assets but rely instead on a term structure equation to tie the markets together. This approach is based on the assumption that all these securities are perfect substitutes in lender portfolios.

This suggests that an analysis of market segmentation should determine whether all financial market instruments are in fact homogeneous. If financial market instruments can be shown to be homogeneous, they may be aggregated and there is no need for modeling the market clearing process for different types of financial assets. If they are less than perfect substitutes, however, we know that market structure is important and will affect interest rates or credit rationing in particular markets.

Financial assets can be classified in a number of ways, with each classification expressing a different perception of market segmentation. The term structure literature, for instance, focuses on the relevance of the term to maturity as an argument of a debt instrument. As mentioned above, model builders using the term structure approach assume that securities of different maturities are essentially homogeneous. Another classificatory criterion is liquidity. This requires a separate analysis for each of the following markets: the market for the highly liquid deposits at banks and savings and loan associations; the market for short-term securities, which are also very liquid but different from deposits because they carry some interest rate risk; the market for long-term assets for which the risk of capital gains and losses is substantial; and the market for loans which is characterized by very limited liquidity.

Yet another criterion is whether a particular financial asset is traded in a national market or whether its market is essentially a local one. The meaning of a local market and localized claims will be discussed below. At this point it may suffice to say that some obvious candidates for local classification are residential mortgages, consumer credit, bank loans to business, and deposits at banks and savings and loan associations. Numerous studies dealing with national aggregates have established that each of these broad categories of financial assets is traded in a submarket in the sense that market participants do not view them as perfect substitutes (Silber (1975) provides a survey.). The issue here, however, is whether the debt instruments of different local markets are in fact homogeneous. Clearly, this would not be the case if the yield on a particular financial asset varied regionally or if local markets were characterized by differential credit rationing.

As discussed in chapter 2, none of the current regional econometric models explicitely allows for regional credit rationing effects. On the contrary, it is assumed that capital is very responsive to interest rate differentials with the effect of quickly equalizing regional rates of return. In some regional studies it is argued that differential returns cannot be maintained because the capital market is dominated by national financial intermediaries. Domination of the capital market by national financial intermediaries, however, is neither a necessary nor a sufficient condition for interregional capital mobility. On the one hand, capital could still move freely if "local" intermediaries were closely linked to efficient secondary markets. On the other hand, regional capital market imperfections could persist if national intermediaries were not responsive to regional interest rate differentials.

Life insurance companies are among the financial intermediaries that participate primarily in national markets. In fact, with respect to mortgage lending, they transfer funds over large geographic areas to a much greater extent than any other private intermediary. It appears reasonable to expect, therefore, that they should play a key role in equilibrating regional imbalances in demand for mortgage funds. H.C. Smith (1968), in a study of the institutional aspects of interregional mortgage investment, found however, that life insurance companies give little or no consideration to maximizing yields on their geographic distribution of mortgages. Other factors, such as correspondent relationships, state laws governing mortgage lending, and predetermined geographic diversification dominate their portfolio decisions, and life insurance companies cannot be regarded as an equilibrating force. In the nation, as well as in Florida, the relative importance of life insurance companies as home mortgage lenders has diminished rapidly over the past decade or so. Whereas insurance companies provided 17.6 percent of the total amount of 1-4 family home mortgages in 1960, their market share dropped to less than 4 percent by 1975, with the gap filled by local lenders (Life Insurance Fact Book 1975).

The second interregional mortgage lenders are mutual savings banks. No mutual savings banks are chartered in the state of Florida, however, and their holdings of Florida residential mortgages are insignificant compared to the holdings of savings and loan associations.

In the context of interregional mortgage lending another factor is federal government agency participation in the mortgage market. The most important agency is the Federal National Mortgage Association (FNMA) whose basic function is to provide a secondary market for residential loans. Since 1970, purchases of residential mortgages have outrun sales by such a wide margin, however, that many experts view FNMA as a lender with a permanent loan portfolio rather than as a secondary market corporation (Savings and Loan Fact Book 1976). Since FNMA borrows in the national credit market and conducts business with mortgage bankers who participate in its regular auctions of mortgage pledges, FNMA activities can be expected to have a positve effect on interregional flows of funds. A quantification of the net regional impact of this government-sponsored corporation appears very difficult, however, since its decisions are not only influenced by purely economic considerations. The

Secretary of Housing and Urban Development, for example, may require the corporation to allocate a certain portion of its mortgage loan purchases to programs related to national housing goals. This may or may not contribute to an efficient regional allocation of capital.

By far the most important home mortgage lenders are savings and loan associations (S&Ls). At year-end 1975 they provided more than 50 percent of total single-family financing in the United States and about 70 percent in the state of Florida (Savings and Loan Fact Book 1976). The activities of S&Ls are governed by a myriad of laws and regulations. There are set geographic limits on making loans, such as 100 miles from the home office, for federally chartered and some state chartered associations, or they may be restricted to in-state loans. S&Ls operate almost exclusively in local markets. (Where branch banking is permitted, flows of funds among regions within a state occur via transfers among branches.In this case, the concept of a local market simply applies to the area covered by all the banking facilities together.) Generally, more than 80 percent of S&L liabilities consist of locally collected savings deposits while their investments are limited by law, regulation, and custom to loans secured by residential real estate property. On the average, about 85 percent of their assets consist of mortgage loans (Savings and Loan Fact Book 1976).

Commercial banks participate in local and national markets. On the borrowing side, the relatively small banks face a local market for their deposits. On the lending side, the local dimension is essentially determined by the size of the borrower. Small borrowers can usually only borrow locally.

The conclusion seems clear. In addition to legal barriers, a main determinant of the spatial dimension of certain financial asset markets is information costs. For example, it is typically argued that small residential mortgage lending can only be done by a locally based institution because of the required knowledge concerning the economic characteristics of the local real estate market, the credit-worthiness of the home buyer, and because of the mortgage servicing costs. In fact, the enormous financial difficulties a large number of mortgage investment trusts (REIT's) have experienced since 1974 indicate that in depth knowledge of local real estate market characteristics is also a sine qua non for the success of relatively big lending operations.

Lending to small borrowers or home mortgage lending outside a bank's immediate area is possible only by incurring extra information costs. As the additional costs of lending interregionally are passed forward in terms of higher rates, interregional loans become poor substitutes for local loans. Similarly, added information costs and decreasing liquidity of their funds with increasing geographic distance make it most economical for small depositors to deposit their savings at local institutions.

As indicated above, the mere existence of regional markets for financial assets is not a sufficient condition for regional compartmentalization. Two additional conditions have to be fulfilled:

1) Imperfect competition in the market for the regionalized banking services; and/or

2) Differential regional responses to changes in aggregate credit conditions.

The problem of price discrimination has received some attention in the literature (Harris 1973) and the general conclusion is that the degree of bank concentration explains most of the regional variation in interest rates (Straszheim 1969). Rate discrimination leads to regional misallocation of resources. Investment is less than socially optimal in regions with greater discrimination as marginal rates of return on physical capital are higher, and conversely, in low rate areas (Meyer 1967).

In this study the major concern is with short-run cyclical changes at the regional level in response to particular monetary policy actions. Therefore, the transmission mechanism of national monetary impulses to the regional submarkets must be investigated.

3.3 The Linkages Between Local Markets and the National Capital Market

In the preceding section, I showed that the U.S. capital market has to be viewed as a set of closely linked submarkets. The factors that might lead to a regional compartmentalization were discussed and it was found that the two national financial intermediaries, life insurance companies and mutual savings banks, do not, in fact, even out regional imbalances.

In this section, it will be shown how the local intermediaries, savings and loan associations, and, to some extent, commercial banks, are linked to national submarkets. I will then develop a methodology to examine whether the two basic linkages lead to a reduction in regional compartmentalization or whether they are the source of a regional modification of national monetary policy actions.

The first link between local and national markets can be identified in the market for savings deposits. Savers can either deposit their savings in local institutions or they can directly invest in money market instruments. They often have an incentive to do so because rates at financial institutions typically lag behind rates of market instruments. Savers seeking to maximize their earnings, withdraw part or all of their savings deposits and move into securities when market yields rise above the yield on savings deposits (disintermediation). They move back into savings deposits when their yield exceeds the market yield (reintermediation). This behavior of depositors has become more pronounced at successive "crunches" and resulted in an extreme volatility of savings at thrift institutions in the 1967-1975 period despite the introduction of a wide assortment of different types of accounts.

If there are regional differences in the interest sensitivity of depositors - maybe because of differences in the money management sophistication on the part of depositors, because of relatively more large accounts, or because of other factors that affect transactions costs - one would expect regional variations in deposit flows when market interest rates shift. These variations, however, cannot be detected by simply comparing statistics like "net savings receipts ratio," for example, because statistics of this nature capture the combined effects of all the determinants of savings flows. They might give misleading information if losses from interest sensitive accounts are offset by inflows into less interest sensitive accounts.

To determine regional differences in deposit flows, regional deposit flow equations can be estimated. Differential regional effects of changes in yields of money market instruments, for example, would show up in regionally different interest rate elasticities of demand for deposits. Clearly, regions with higher interest rate elasticities would be more affected by swings in short-term market interest rates.

The second link between the local market and the national capital market has to do with the fact that the portfolios of regional intermediaries consist of local investments as well as secondary market instruments. Changes in relative rates of return will have differential regional effects if there are regional differences in the portfolio behavior of bankers and S&L managers. Local banks are linked to the national money and capital markets primarily through the government securities and the federal funds markets. The link for savings and loan associations is also through the government securities market and in addition they are linked through Federal Home Loan Bank System lending.

Building on the work of Silber (1970), who examined the general portfolio behavior of the major U.S. financial intermediaries, I will examine the portfolio behavior of banks and S&Ls at a more disaggregated level. In particular, I will determine the degree of substitutability between local investments and secondary market instruments in the portfolio of banks and S&Ls operating in a regional setting. This can be accomplished by estimating, for each intermediary, demand equations for each of the various kinds of investments. The estimated coefficients will be used to calculate the degree of substitutability between these investments. A low degree of substitutability between local investments and investments in the secondary market would be a sign of relatively pronounced regional compartmentalization. High substitutability would indicate close integration with the national markets.

A finding that portfolio behavior patterns differ across regions would confirm the hypothesis that monetary policy has differential regional effects on economic activity. Even if the portfolio behavior of one intermediary did not display any regional variation, differential regional effects would still result from differences in regional market structures.

3.4 Development of a Model of Portfolio Allocation

Since the assumption of utility maximization for households and the assumption of profit maximization for financial intermediaries lead to a very similar specification of their respective demand equations for financial assets (Gramlich and Hulett 1972, Silber 1970), I will develop in this section the general model. The necessary modifications for the analysis of the portfolio behavior of regional intermediaries and for the estimation of regional deposit flow equations will be made in the following two sections.

Based on the framework developed in Brainard and Tobin (1968) and Smith and Brainard (1973), the equilibrium demand is specified as follows:

$$(3.1) \quad A^* \equiv \frac{a^*}{W}$$

where: A^* = n x 1 vector of the ratios of net assets to wealth;

a^* = n x 1 vector of long-run equilibrium levels of assets and liabilities;

W = budget constraint (wealth, deposits).

In words, (3.1) states that asset holdings are homogeneous in wealth.

(3.2) $A^* = BX$

where: $B = n \times m$ matrix of coefficients;

$X = m \times 1$ vector of explanatory variables.

Equation (3.2) specifies the long-run desired portfolio as a linear function of m independent variables. Using the assumption underlying the risk-return model, Gramlich and Hulett (1972) show that X is a vector of own and competing rates of return, with the coefficients depending on the variance-covariance matrix of expected rates of return.

An implicit constraint in equation (3.2) is

(3.3) $iA^* = 1$

where: $i = 1 \times n$ unit vector.

That is, the sector's desired demands must satisfy its balance sheet constraint. But this implies two adding up constraints

(3.4) $\sum_{i=1}^{n} B_{io} = 1$

where: B_{io} = constant terms; and

$$(3.5) \quad \sum_{i=1}^{n} B_{ij} = 0, \qquad j = 1,\ldots,n$$

That is, a change in the holdings of any asset must be at the expense of the remaining assets.

These restrictions have to be imposed on the estimation process in order to obtain consistent estimates of the coefficients. This can be done by using an explicit constrained estimation technique. G. Smith (1975) has shown, however, that ordinary least squares parameter estimates will generally obey adding up restrictions if the regressors are the same in each equation and if some linear combination of the regressors is always equal to the sum of the regressands.

Since the system is not continuously in equilibrium, a dynamic equation must be specified. The most commonly used specification is the stock adjustment principle,

$$(3.6) \quad \Delta A = K_1 \, (A^* - A(-1)) + K_2 Z$$

where: A = n x 1 vector of current, actual proportions of assets and liabilities;

Z = p x 1 vector of variables that affect the adjustment pattern;

K_1 = n x n matrix of adjustment coefficients; and

K_2 = n x p matrix of reaction coefficients.

Equation (3.6) can be rewritten as

$$(3.7) \quad A = K_1 BX + (I-K_1) A(-1) + K_2Z$$

where: I = n x n identity matrix.

The simultaneous equation system to be estimated will look like

$$(3.8) \quad A = C_1 X + C_2 A(-1) + C_3Z$$

and the equation for an individual asset i can be written as

$$(3.9) \quad A_i = c_1 X + c_2 A(-1) + c_3Z$$

where: c_k = i^{th} row vector of C_k , k=1,2,3.

The current, actual proportion of any asset in the portfolio is a function of all the relevant interest rates, the stocks of assets lagged one period, and other variables which might influence short-run portfolio adjustments. It is apparent at this point that data limitations will make it impossible to fully incorporate all the information that is required to obtain consistent estimates of the parameters.

The vector A(-1) will usually only contain the own stock lagged and it is very likely that I will have to impose zero restrictions on c_1 because of the presence of multicollinearity in the vector of interest rates X. This really amounts to estimating under the assumption that the flow into a financial asset depends only upon disequilibrium in the market for that asset, and not upon the state of excess demands in the markets for other assets. Although some specification error is involved and the stock adjustment coefficient will be biased if the own lagged stock is correlated with other lagged stocks, it has been shown that the approximation to the true model is quite close when only one demand equation is estimated (Fortune 1972).

The inclusion of the variables Z serves to modify the stock adjustment process in the sense of explicitely allowing for two sources of flows into a particular asset: flows arising from the reallocation of assets and net new flows into assets. Thus, the vector Z will basically consist of the latter flow variables and the specification of the model allows for the possibility that the public and banks treat the allocation of the initial stock of assets in a manner different from their treatment of the allocation of new flows into financial assets.

3.5 A Model of Regional Deposit Flows

In section 3.3, I argued that regional variations in deposit flows could be one of the main sources of regional compartmentalization in the mortgage market. In particular, I suggested that savers in different regions could be more or less sensitive to changes in yields on open market instruments that they regard as substitutes for the local intermediaries'liabilities. In addition, there could be regional differences in the degree of substitutability between savings deposits at local S&Ls and savings deposits at local commercial banks. In this section I will specify a model of household demand for savings deposits at savings and loan institutions and at commercial banks at the regional level. The estimation results for different regions will provide a comparison of regional differences in the demand for these deposits.

The specification of the determinants of the public's demand for savings deposits is based on standard portfolio considerations that are usually applied as a framework for analyzing the demand for liquid assets. The corresponding general model was developed in section 3.4 and can be used with slight modifications for the problem at hand.

Household allocation choices following a change in net worth, relative prices, and other factors are beyond the data availabilities of a small statistical model. Simplifying assumptions must be made in order to derive meaningful results. The most frequent assumption (Fortune 1972, Bosworth and Duesenberry 1973) -- and the one adopted here -- is that household allocation choices are a series of decisions at different degrees of aggregation.

Whereas the first part of the recursive decision making process may involve the allocation among current consumption, investment in physical assets, and investment in financial assets, I will focus on the decision of allocation among liquid assets. Therefore, the appropriate constraint in equation (3.1) is the aggregate of liquid assets. The structure of the desired balance sheet and the public's adjustment behavior are assumed to be appropriately described by equation (3.9) which is reproduced for convenience.

$$(3.9) \quad A_i = c_1 X + c_2 A(-1) + c_3 Z$$

The dependent variable is the ratio of a homogeneous class of deposits to total liquid assets. The vector X contains the own interest rate, the yield on the competing local financial intermediary's deposits, and a vector of market interest rates. The own rate coefficient is postulated to be positive. The coefficients associated with competing rates are postulated to be negative. A variable Z that would affect the adjustment pattern positively might be the change in disposable personal income.

From the estimated coefficients the regional interest rate elasticities can be calculated. Of particular interest is the open market rate elasticity since this elasticity will indicate the extent to which an intermediary in a given region is subject to disintermediation. Other measures of the regional sensitivity of thrift deposit flows to open market rate competition are the marginal interest sensitivity, defined as the impact of a change in opportunity costs upon the level of savings deposit flows, and the percentage change in thrift deposit flows arising from a change in opportunity cost.

All these measures will give a quantitative assessment of the regional impact of changes in monetary policy as reflected in shifts in the yields of money market instruments. In addition, they will produce valuable information about the regional institutional structure because the above mentioned measures of interest sensitivity will also be applied to commercial bank rate competition as well as S&L rate competition.

3.6 A Model of the Portfolio Behavior of Regional Intermediaries

For the general theory of portfolio behavior of financial institutions, this section draws heavily on Silber (1970). I will extend his analysis of the various substitute-complement relationships among different categories of securities in lender portfolios in two directions: 1) I will examine the portfolio behavior of financial intermediaries at the more disaggregated regional level, and 2) I will use different behavioral assumptions for commercial banks. Furthermore, this study focuses on the substitute-complement relationships between two broad categories of investments: local assets versus assets traded in national markets. This will determine if there are regional differences in the response of financial intermediaries to changes in aggregate credit conditions. In the affirmative case, the conclusion would be that monetary policy has differential regional impacts.

The hypothesis to be tested is that open market instruments are good substitutes for local investments in the portfolios of local financial intermediaries. This would indicate a low degree of regional compartmentalization of the capital markets on the lending side.

In analogy to consumer demand theory, two securities are defined as substitutes if $\delta A / \delta r_b$ is negative, where A is the demand for security A and r_b is the rate of interest on security B. Correspondingly, two securities are complements if $\delta A / \delta r_b$ is positive.

In order to make these definitions operational, I will estimate demand equations for each asset by type of financial intermediary. The basic format of these equations is again given by

$$(3.9) \quad A_i = c_1 X + c_2 A(-1) + c_3 Z$$

Total assets or total deposits will act as a budget constraint. The vector X contains the asset's own yield and the yields of the various competing assets. The vector Z contains flow variables for the different sources of loanable funds. It must be expected that the composition of a change in total loanable funds affects the portfolio allocation decision.

Since the regression coefficients can be interpreted as partial derivatives, the estimates of the coefficients associated with competing rates will measure the substitution effect. It is not quite clear whether this is a gross substitution effect (including the income effect) or a net substitution effect. Silber (1970) argues that financial intermediaries are probably subject to an income effect but ignores the problem subsequently whereas Feige (1964) assumes that it is negligible. I will take this issue up in the next chapter when I discuss the empirical results.

From a practical point of view it is not sufficient to say that a negative coefficient implies substitutability. Tests to determine the statistical significance of the estimated coefficients and to establish regional differences in the portfolio behavior will be utilized and the difference between two corresponding coefficients must also be statistically significant. Also, a priori information will be fully used as necessary. In the chosen framework the own rate coefficient, for example, has to be unambiguously positive. Since I will be estimating separate demand equations for each asset, I can check the consistency of the results by comparing the estimates of corresponding coefficients. That is, in the absence of an income effect, $\delta A / \delta r_B$ should be equal to $\delta B / \delta r_A$.

3.6.1 Savings and Loan Associations

While there is little disagreement among economists that commercial banks act as profit maximizers, studies on the microeconomic behavior of savings and loan associations, most of which have a mutual type of organization, are far from reaching a consensus on their behavioral motivation. Goldfeld (1966) and Hester (1968) concluded that S&Ls basically act without well defined goals. In a recent study of the deposit rate setting behavior of S&Ls, however, Slovin and Sushka (1975) demonstrate convincingly, that S&Ls act in a manner consistent with profit maximation. Therefore, I will use this assumption for the following analysis. With the focus on estimating asset demand equations, it is important to note that S&Ls have much less portfolio flexibility than commercial banks. This is because the savings and loan industry is highly regulated. S&Ls' investments are limited mainly to loans secured by residential real estate, and particularly to loans on single family homes. Between 1967 and 1975 year-end, mortgage holdings of all S&Ls varied from 82.5 percent of total assets to 86.5 percent of total assets (Savings and Loan Fact Book 1976). The only other single asset category of any importance was investment securities, representing about 8 percent of total assets. While associations legally can purchase many kinds of securities, the securities portfolio consists virtually exclusively of government bonds. An important decision variable for S&Ls is the amount of borrowing from the FHLB System. While this was a relatively unimportant source of loanable funds until the late '60s, FHLB advances grew 75 percent in 1969, from $ 5.2 billion to $ 9.2 billion. In the early '70s advances dropped substantially but picked up again in 1973 to reach a peak of $ 21.8 billion by year-end 1974 (Savings and Loan Fact Book 1976). Advances are subject to a wide range of terms and conditions. Probably the most important regulation in the present context is that the maximum borrowing limit for any association is set at an amount equal to 50 percent of its total savings balances. Since savings and loan associations have to pay competitive rates on FHLB advances - in fact the FHLB System had record earnings during a period when the housing industry was in the midst of a depression - I will treat FHLB advances simply as negative assets. The structure of the demand equation will be essentially unchanged.

3.6.2 Commercial Banks

The investigation of regional differences in the portfolio behavior of commercial banks will focus on the degree of substitutability between investments in the national market, in particular their holdings of Government bonds and municipals, and local investments such as commercial loans and mortgage loans. In contrast to models that employ nationally aggregated data and treat the commercial loan rate as a decision variable, I will assume that local loan rates differ from the national rate only by a constant. In other words, I assume that cyclical variations in the yield spread that might possibly exist because of imperfect competition in the local market are negligible. This will allow the estimation of regional demand equations for commercial loans. Therefore, I can examine the degree to which both types of local assets are substitutes for nationally traded securities.The structure of all the demand equations will correspond closely to the specification of the general equation discussed at the beginning of this section.

3.7 Institutional Aspects of the Mortgage Market

The preceding discussion of the intermediaries' demand equations for financial assets and the interpretation of the coefficients is based on the implicit assumption that all asset markets are continuously cleared.

Since many authors (Jaffee 1972, Kalchbrenner 1972) maintain that disequilibrium prevails in the mortgage market, this point needs further elaboration and will be taken up below. After this, I will discuss institutional arrangements such as mortgage commitments and mortgage repayments which form an integral part of the mortgage lending process of savings and loan associations.

3.7.1 The Mortgage Market and Market Disequilibrium

The demand for mortgage credit is best analyzed in the framework of household portfolio behavior outlined in section 3.4. In that framework, the assumption of expected utility maximization implies that households will borrow until the marginal disutility of borrowing is equal to the marginal utility of their assets. With respect to mortgage credit, however, the market value of the house which serves as collateral is an effective constraint on the amount of credit a household can obtain. Therefore, in the model developed in section 3.9, aggregate household demand for mortgage credit is one equation in the system of equations

$$(3.7) \qquad A = K_1 BX + (I-K_1) A(-1) + K_2 Z$$

with the variables as defined in section 3.4.

One would expect that the mortgage rate, contained in the vector X, should turn out to be significant. The collateral requirement can be incorporated by specifying the net change in the outstanding stock of houses as one of the variables Z. Capital gains on existing houses could be incorporated in the same way although it appears doubtful that they would have a significant short run effect.

If the mortgage rate were always a market clearing rate, one could next specify the supply relationship and would then have a complete model of the residential mortgage market. However, one of the contentions of this study is that the mortgage market is characterized by credit rationing. National models of the demand for and supply of residential mortgage credit that allow for credit rationing, that is, a disequilibrium mortgage rate, typically assume that the mortgage rate adjusts only gradually toward its equilibrium value (Jaffee 1972, Huang 1966). In a recent paper, Fair and Jaffee (1972a)offer a theoretically more satisfying specification of markets in disequilibrium. They suggest four methods to separate the sample into demand and supply regimes such that the coefficients of the demand equation and the supply equation can be estimated from the observed quantities of the sample points falling within the respective regime. Their application of these methods to the housing and mortgage market yielded rather disappointing results, however, in the sense that their coefficient estimates were very similar to the estimates obtained under the assumption of full equilibrium. While this does not warrant the conclusion that nonprice rationing is unimportant in the mortgage market - in fact, the variable that was to pick up market disequilibrium turned out to be significant - their findings might indicate that national data are too aggregated for an analysis of market disequilibria or that their specification of the mortgage market is inappropriate. It appears that a regional analysis of the mortgage market offers two unique opportunities. First, given the local nature of the residential mortgage market, the data used will be at the appropriate level of disaggregation. Second, for forecasting purposes, the lending institutions can be assumed to be price-takers in the mortgage market or at least it can be assumed that a possible interest rate differential between the local and the national mortgage rate does not vary significantly over the business cycle. Together with the common assumption (Kalchbrenner 1972) that credit rationing occurs only in the sense of excess demand, this implies that I can restrict the analysis to an estimation of the supply relationships.

3.7.2 The Supply of Mortgage Credit

Existing theoretical and empirical studies of the supply of mortgage credit (= the demand for mortgages as securities) display marked differences in the extent to which they are disaggregated and particularly in their treatment of institutional factors influencing mortgage credit supply (Kalchbrenner 1972).

In this study, I will develop separate models for the two principal suppliers of residential mortgage credit, savings and loan associations and commercial banks, at the state level. For savings and loan associations this will include the specification of advance commitments and mortgage repayments in addition to the mortgage flow equations that will be estimated for S&Ls as well as commercial banks.

The general approach is the one outlined in the section on portfolio behavior of financial institutions. That is, demand equations are specified for mortgages for each intermediary. Dependent variable, functional form, independent variables, and dynamic adjustment equation all have been discussed in section 3.4.

The relevant equation in the system of equations (3.8) has the following specification :

$$\frac{MTG}{D} = c_1 X + c_2 A(-1) + c_3 Z \tag{3.10}$$

where: MTG = mortgage holdings;

D = total deposits;

c_1 = 1 x m vector of coefficients;

X = m x 1 vector of interest rates;

c_2 = 1 x n vector of coefficients;

A = n x 1 vector of asset proportions;

c_3 = 1 x p vector of coefficients;

Z = p x 1 vector of variables that affect the adjustment pattern.

For commercial banks, I would expect that the vector Z should contain the net flow variables for demand deposits and time deposits since bankers probably differentiate in the allocation of these two sources of funds to the relatively illiquid mortgage investment.

For savings and loan associations, the equation has to be modified in order to allow for the following important institutional features of the savings and loan industry:

1) Federal Home Loan Bank advances;
2) Advance mortgage commitments; and
3) Data availability for mortgage repayments.

FHLB advances will enter the equation in two ways. First, the borrowing rate represents an opportunity cost to S&Ls and is therefore contained in the vector X. The justification for this has been given in section 3.5. Second, it is sometimes maintained (Huang 1969) that the quantity of FHLB advances is really the policy tool. For this reason, the change in advances should be incorporated in the vector Z .

The role of advance commitments will be discussed below. It may suffice to say here that they are expected to be an important determinant of mortgage credit supplied by S&Ls. They will enter the equation also as one of the variables in vector Z.

The fact that data are available for mortgage repayments permits the estimation of the gross flow of mortgages instead of only the net flow as in the case of commercial banks. A model for the flow of mortgage repayments will be developed at the end of this chapter. The estimated flow will be specified in the mortgage demand equation in the same way as the other sources of loanable funds, net deposit flows and FHLB advances, namely as one of the variables in the vector Z.

Retained earnings will not be explicitely specified because they are relatively unimportant as a source of funds - less than 2 percent of total loanable funds in 1975 - and also because their variation in absolute amounts is insignificant compared to the fluctuations in net savings receipts, for example.

3.7.3 Mortgage Commitments and Repayments

The significance of advance commitments in the mortgage lending process of savings and loan associations derives from the fact that it is standard practice in the industry that potential borrowers, individual homeowners or builders, seek commitments from savings and loan associations to make a mortgage loan of a given amount at a specified rate.

The commitments are binding upon the S&L for a certain period of time but they are not binding upon the potential mortgagor. In fact he may try to get a second commitment from another institution or if he expects mortgage terms to ease, he may not take down the original commitment in the hope of getting a commitment at more favorable terms in the future. For this reason, it is sometimes argued that expected trends in mortgage credit are reflected in the commitment take-down ratio.

Lender behavior appears to be mainly influenced by the availability of loanable funds. That is, during periods of tight money or when they expect market interest rates to rise, they tend to limit new commitments. As explained above, under the same set of circumstances the take-down ratio is high. It appears therefore that one of the main gains derived from explicitely specifying the advance commitment process is insight into the dynamics of the mortgage market.

The general specification of the new commitments equation for S&Ls should be very similar to the demand equation for mortgages because a commitment implies the decision to make a mortgage loan at some future date. The only difference, therefore, is expected to be in the lag structure of the independent variables accounting for the effect of expectations about credit market conditions. The equation for new commitments by S&Ls will therefore be specified as

$$\frac{NCS\&L}{DS\&L} = c_1 X - c_2 \frac{MTGS\&L(-1)}{DS\&L(-1)} + c_3 Z \tag{3.11}$$

where: NCS&L = new commitments by S&Ls;

DS&L = deposits at S&Ls;

c_1 = 1 x m vector of coefficients;

X = m x 1 vector of interest rates;

c_2 = adjustment coefficient;

MTGS&L = mortgage holdings of S&Ls;

c_3 = 1 x p vector of adjustment coefficients;

Z = p x 1 vector of variables that affect the adjustment pattern.

Assuming that the proportion of new commitments taken down in the current period is negligible, outstanding commitments will be defined as follows :

$$\text{(3.12)} \quad OCS\&L = (1-TR)\ OCS\&L(-1) + NCS\&L$$

where: $OCS\&L$ = outstanding commitments at S&Ls;

TR = proportion of outstanding commitments cancelled or taken down.

The take-down ratio depends solely on the decisions of potential borrowers. One would expect it to vary directly with an increase in the mortgage rate and quite likely also with rising housing costs because of increased cancellations.

$$\text{(3.13)} \quad TR = \frac{OCS\&L(-1) + NCS\&L - OCS\&L}{OCS\&L(-1)}$$

$$= d_1 * \Delta RM + d_2 * \Delta PRC$$

where: d_1 = 1 x q vector of coefficients;

ΔRM = q x 1 vector of mortgage rate differentials;

d_2 = 1 x r vector of coefficients;

ΔPRC = r x 1 vector of residential construction index differentials.

The final task in this section is the development of an equation for repayments of mortgages at S&Ls. Mortgage portfolio inflows are a very important source of loanable funds for S&Ls. Between 1967 and 1975 repayments provided between 43 percent and 74 percent of total loanable funds. During the same period the ratio of repayments to the average portfolio ranged from 10 percent to 16 percent (Savings and Loan Fact Book 1976). These figures are based on annual data; quarterly data would yield even wider fluctuations. Mortgage loan repayments are affected mainly by the following factors:

1) Size of the mortgage portfolio. (Homogeneity can be assumed);

2) Changes in the maturity structure (Probably insignificant after 1967);

3) Real estate activity (Should have a positive effect); and

4) Interest rates. (During periods of high mortgage interest rates, buyers will try to assume existing low interest rate loans and new borrowers will keep the amount they borrow as small as possible.).

This leads to the following specification of the repayments equation:

$$\frac{RP}{MTGS\&L} = a\ \Delta RM + bT \tag{3.14}$$

where: RP = mortgage repayments at S&Ls;

MTGS&L = mortgage holdings of S&Ls;

a = 1 x n vector of coefficients;

ΔRM = n x 1 vector of mortgage rate differentials;

b = 1 x m vector of coefficients;

T = m x 1 vector of measures of real estate activity.

This discussion of the mortgage market completes the theoretical analysis of the regional compartmentalization of capital markets. The next chapter will be devoted to an empirical analysis based on the just developed theory.

CHAPTER 4

REGIONAL COMPARTMENTALIZATION OF CAPITAL MARKETS: AN EMPIRICAL ANALYSIS

4.1 Introduction

In this chapter, I will empirically estimate the models developed in chapter 3 to test the three-fold hypothesis that there are significant regional differences in

(1) the demand for deposits at savings and loan associations and/or at commercial banks;

(2) the portfolio behavior of savings and loan associations; and

(3) the portfolio behavior of commercial banks.

The selection of the sample states was guided by three criteria. First, the analysis should be restricted to states where no mutual savings banks are chartered since this would further aggravate the problem of multicollinearity and impinge on hypothesis testing. Second, Florida and California had to be included in the sample. Florida, because I would be able to expand on the results of these estimations in chapter 5. California, because it is often alleged that California savings and loan associations have different behavior patterns than those of other regions (Dhrymes and Taubman 1969). Third, the sample should contain some small "rural" states where market compartmentalization could be expected to be highest.

After some states had to be eliminated because they did not meet the data requirement for consistent and complete quarterly time series since 1969, the final sample comprised California, Florida, and Ohio as a group of large states. South Carolina, New Mexico, and Idaho represented the small states.

In the next section, I compare and contrast some summary statistics of financial activity in the sample states. Section 4.3 is devoted to an analysis of the estimated deposit flow equations. In section 4.4, I interpret the estimation results for the portfolio behavior of the savings and loan industry, and section 4.5 contains an analysis of the corresponding commercial bank equations. In section 4.6, I summarize the major findings of this chapter. Notes, notation, and variable definitions are presented in section 4.7.

4.2 A Comparison of the Size and Relative Importance of Savings and Loan Associations and Commercial Banks in the Sample States

Before interpreting the estimation results, it appears appropriate to provide some information about the order of magnitude of the variables of interest and the nature of the competitive environment. Summary statistics for the savings and loan industry are presented in Table 4.1. Information on the commercial banking industry is summarized in Table 4.2. In addition, each of the tables listing regression results contains the mean of the dependent variable which should help to keep the right perspective.

In terms of size, the State of California clearly dominates the sample. Mean deposits at California savings and loan associations and commercial bank time deposits in California are of the same order of magnitude and roughly 2.5 times larger than the corresponding figures for Florida and Ohio, respectively. These two states are in fact remarkably similar with respect to average values.

The small states in the sample are dwarfed by the big three. Idaho's savings and loan industry, for example, is about 100 times smaller than California's.

Table 4.1 - Selected Balance Sheet Data of Savings and Loan Associations in the Sample States from 1969 to 1975

	DEPOSITS				MORTGAGES	FHLB ADVANCES		DEPOSITS/STATE PERSONAL INCOME
	Mean	69:1	75:4	Growth	Mean	Mean	Coef.of Var.	
CA	33.0	24.6	46.7	190%	35.5	3.6	31%	1.23
FL	12.8	6.7	21.2	315%	12.3	.5	93%	1.50
OH	13.1	9.3	18.5	200%	12.9	.5	53%	1.02
SC	2.0	1.3	3.0	235%	2.0	.1	56%	.81
NM	.6	.4	1.0	255%	.6	.02	59%	.61
IO	.3	.2	.5	205%	.3	.01	33%	.45

Notes, notation, variable definitions: Section 4.7.

Table 4.2 - Selected Balance Sheet Data of Commercial Banks in the Sample States from 1969 to 1975

	DEMAND DEPOSITS		TIME DEPOSITS		MORTGAGES
	Mean	Growth 68:12-75:6	Mean	Growth 68:12-75:6	Mean
CA	23.4	150%	35.7	195%	12.4
FL	8.4	160%	9.0	260%	2.6
OH	10.0	114%	14.4	175%	4.9
SC	1.8	160%	1.1	285%	.4
NM	.9	175%	1.0	300%	.2
IO	.7	160%	1.0	265%	.3

Notes, notation, variable definitions: Section 4.7.

In marked contrast to the first group, commercial banks in the small states have grown much faster than S&Ls during the sample period. This may have to do with a lagged structural adjustment in the small states. That is, depositors in California and Ohio shifted out of demand deposits and into time deposits much earlier than depositors in the small states. In fact, Figures 4.2 to 4.4 indicate that individuals in small states were reducing their holdings of demand deposits and increasing their holdings of time deposits when in the larger states depositors were already switching from bank time deposits to the higher yielding S&L deposits.

As explained in chapter 3, S&Ls invest nearly 100 percent of their deposits in mortgages. Table 4.1 shows that this is true for five out of the six states. California S&Ls, however, were heavy borrowers from the Federal Home Loan Bank System between 1969 and 1975 and their average mortgage holdings exceed their deposits by 2.5 billion dollars.

In each of the six states, S&Ls provide more mortgage money than commercial banks. While this is just barely true for New Mexico, Florida S&Ls completely dominate the mortgage market with an average market share of about 85 percent.

Since mean values can be misleading in the presence of widely differing growth rates, I have also provided simple growth rates in Tables 4.1 and 4.2. It is interesting to note, for example, that deposits at Florida S&Ls trailed Ohio deposits in the first quarter of 1969 but exceeded Ohio deposits in 1974:4 by nearly 3 billion dollars. It has to be expected that these differences will show up in the estimated coefficients.

In this context, a few remarks about the chosen sample period are in order. The deposit flow equations and all S&L equations were estimated from 1969:1 to 1975:4, using quarterly data. While the end point is given by data availability considerations, some of the time series would have been available for longer periods than the one used for estimation. Long time periods are usually desirable because more reliable parameter estimates can be obtained. This is not true, however, if structural changes occur during the sample period. Indications are that structural shifts did occur in the financial sector in general in the late sixties (Pierce and Thomson 1974) and in the mortgage sector in particular with the emergence of the Federal National Mortgage Association (FNMA) as an important market force. Therefore, I decided to start in 1969:1, which makes 28 observations and usually leaves about 24 degrees of freedom.

Unfortunately, for the commercial bank equations only semi-annual call report data were available at the state level. Consistent time series for all states in the sample started with the December, 1966 call report and ended with the June, 1975 call report. This yielded 18 observations and left about 15 degrees of freedom. As indicated in the preceding paragraph, it is very likely that significant structural shifts occurred in the financial sector of the economy between 1966 and 1975. While I did not have enough observations to formally test for structural stability (applying a Chow test, for example), the following problem - among others - must not be overlooked when interpreting the regression results. In the past decade a distinct shift from asset management to liability management has taken place in the banking industry. No longer will banks simply adjust liquid assets in response to changes in the volume of deposits or loan demand but they will try to tap external sources for liquidity as the need arises. Clear indicators of these developments are the rapid growth of the Federal funds market, the surge in the volume of large negotiable certificates of deposits issued, and the volume of non-negotiable large time deposits outstanding. Since the paucity of my banking data does not allow to specify these and other factors in the estimated equations, their likely impact will be assessed when discussing the regression results.

The estimation technique chosen for the models estimated in chapter 4 is ordinary least squares (OLS). This was dictated by the fact that virtually all of the explanatory variables are either exogenous or lagged endogenous variables because the model developed in chapter 3 is based on the assumption that regional financial intermediaries are price takers in the assets and liabilities markets. In the few instances where a problem of simultaneity might exist -- leading to inconsistency of the OLS estimator -- the model was reestimated by a structural method and the results are presented in chapter 6.

4.3 Deposit Flows

The theoretical deposit flow model (3.9) was estimated with only minor empirical modifications. The final estimated equation is of the following form:

$$(4.1)\quad S1A = b_1 * SA2L + b_2 * RTBL + b_3 * TIME + b_0$$

where: S1A = Δ deposits/state personal income
SA2L= deposits(-1)/state personal income
RTBL= 3-month Treasury bill rate(-1)
TIME= time trend (see page 80)

The regression results are presented in Table 4.3.

Table 4.3 - Savings and Loan Associations Deposit Flows, Estimated Coefficients

	SA2L	RTBL ($x10^{-2}$)	TIME ($x10^{-3}$)	CONSTANT ($x10^{-1}$)	MEAN ($x10^{-2}$)	R^2	SE ($x10^{-2}$)
CA	-.193	-.425	.724	.712	.782	.70	.422
	(3.7)	(6.8)	(5.6)	(4.6)			
FL	-.162	-.456	1.36	.628	1.51	.87	.277
	(3.6)	(11.5)	(5.2)	(6.3)			
OH	-.163	-.213	.607	.437	.650	.84	.149
	(3.7)	(9.6)	(6.0)	(4.8)			
SC	-.112	-.180	.405	.282	.635	.83	.132
	(2.3)	(9.4)	(5.0)	(3.5)			
NM	-.106	-.111	.468	.152	.532	.85	.115
	(2.7)	(7.0)	(6.1)	(3.8)			
IO	-.116	-.084	.132	.173	.298	.78	.074
	(2.5)	(6.6)	(7.5)	(3.1)			

Notes, notation, variable definitions: Section 4.7.

First, it will be noted that personal income was used as a proxy for liquid assets, or wealth, since quarterly data for wealth are not available at the state level. This is not a serious problem, however, because personal income correlates very highly with wealth (Kardouche 1969) and, in fact, is substituted for wealth even in large scale national models (Pierce and Thomson 1974).

The yield on savings deposits (the "own" yield) was postulated to have a positive coefficient. The estimated coefficient turned out to be positive but insignificant and for some states even negative. Therefore, it was omitted in the final version. This result is not quite unexpected. The effective yield on savings and loan deposits increased gradually during the sample period and displayed very little variation. Its effect may have been swamped by income effects and the effects of rapidly changing market rates of interest. In any event, different degrees of regional compartmentalization would be captured by the coefficient of opportunity cost variables, not by the coefficient of the own yield. The own yield could have been made significant by creating a yield spread variable (own yield minus market yield). Again, the variation in the market yield swamped the variation in the deposit yield and the net effect amounted to reducing the market yield by a constant. Statistically, there was no difference between the coefficient of the yield spread variable and the coefficient of the yield on market instruments.

In order to determine the relevant open market yield for S&L depositors, demand equations with the 3- to 5-year Government securities rate, the long term Government bond rate, and the 3-month Treasury bill rate were estimated. While some long rates were statistically significant when used alone, the Treasury bill rate had much more explanatory power in terms of R^2 and t value. Therefore, this rate was retained as a proxy for all open market rates.

Next, I tested for the appropriate lag structure of the T-bill rate. Regressions with polynomial distributed lags showed that in all states, with the exception of California and Florida, the coefficient of the variable lagged one quarter was statistically most significant and the mean lag was about one quarter. For Florida, the current value and the one period lagged value were equally significant. For California, the current value was statistically more significant than any of the lagged values. After this, a simple one period lag on the T-bill rate was tried. The estimated coefficients reported in Table 4.3 are of the same size as the sum of the lagged coefficients of the previous regressions. Since the elaborate lag structure had the undesirable side effect of rendering the lagged stock variable insignificant or changing the sign of its coefficient, the simple lag was retained.

The variable TIME, a simple time trend, had to be introduced because I included only the own lagged stock in the estimated equation and omitted the lagged stocks of all other liquid assets which are specified in model (3.9).A particularly serious specification error appears to occur by the omission of the lagged stock of demand deposits for which no quarterly data are available. The reason for this is that institutional forces such as a generally rising level of interest rates, Regulation Q, high rates of inflation, differences in branching laws, and other factors apparently favored the growth of savings and loan association deposits at the expense of demand deposits. In Florida, for example, the ratio of S&L deposits to total deposits (S&L deposits + demand deposits + time deposits) increased from 37 percent in 1969 to 47 percent in 1975. During the same period, the share of demand deposits dropped from 32 percent to 21 percent and the proportion of time deposits remained practically unchanged. Although resorting to a time trend is intellectually not very appealing, it appears well justified under the given circumstances.

Having discussed the empirical modifications of the deposit flow model, I shall now turn to the analysis of the estimated coefficients reported in Table 4.3.

All the variables are highly significant, the coefficients are of the required sign, and the fit is good (standard error of the equation is about 0.5 percent of the mean stock of deposits).

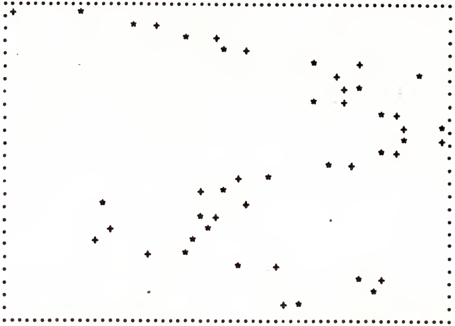
In order to illustrate the extreme swings in deposit flows during the sample period, Figure 4.1 shows a representative plot of actual and fitted values.

In the disintermediation period of 1969, California S&Ls experienced net deposit outflows from 1969:2 to 1970:1. In the remaining states, net outflows were registered as follows: Ohio: 69:2, 70:1; South Carolina: 70:1; New Mexico: 70:1; Idaho: 69:1, 70:1. Florida reached the low point in 70:1. In the second disintermediation phase of 1973/74 only California S&Ls recorded actual outflows. The pattern in the remaining states was quite similar although only Florida experienced 3 quarters in a row of low inflows comparable to 69/70.

Table 4.4 should facilitate a comparison of the relative interest sensitivities of deposit flows. The first measure, interest elasticity of the demand for deposit flows, provides a ranking of the states. It is evident that California depositors are by far the most interest sensitive.

```
                         FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIDUALS                         RANGE     0.00  TO     0.03
 @S1/Y+     @S1/Y*

 0.002      0.005     -0.004   701
 0.010      0.008      0.002   702
 0.013      0.012      0.002   703
 0.015      0.014      0.001   704
 0.022      0.019      0.003   711
 0.020      0.025     -0.005   712
 0.021      0.022     -0.001   713
 0.021      0.019      0.002   714
 0.024      0.023      0.001   721
 0.024      0.026     -0.002   722
 0.026      0.024      0.002   723
 0.024      0.023      0.001   724
 0.021      0.020      0.001   731
 0.015      0.017     -0.002   732
 0.012      0.014     -0.001   733
 0.015      0.007      0.008   734
 0.013      0.012      0.001   741
 0.007      0.013     -0.005   742
 0.006      0.012     -0.005   743
 0.009      0.011     -0.002   744
 0.017      0.015      0.002   751
 0.023      0.022      0.001   752
 0.023      0.023     -0.000   753
 0.017      0.018     -0.001   754
```



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          MSE=   0.000      RMS=   0.003     RHO=   0.108
          MEAN ERR=      -0.0000    MEAN=        0.0167    XMAPE=        0.2697
```

Figure 4.1 - Florida Savings and Loan Associations, Deposit Flows

Table 4.4 - Savings and Loan Associations, Sensitivity of Deposit Flows to Open Market Yields

	ELASTICITY	MARGINAL INTEREST SENSITIVITY (millions of dollars)	PERCENTAGE INTEREST SENSITIVITY
CA	-3.12	-490	-51.8
FL	-1.82	-174	-30.1
OH	-1.92	-116	-31.7
SC	-1.63	- 19	-27.1
NM	-1.16	- 4	-19.4
IO	-1.61	- 3	-26.7

Source: Table 4.2, evaluations at 1969:1 to 1975:4 means.

Definitions: Elasticity = $(\delta(\Delta\text{deposits})/\delta(\text{RTB})) * (\text{mean}(\text{RTB})/\text{mean}(\Delta\text{deposits}))$
Marginal interest sensitivity = $\delta(\Delta\text{deposits})/\delta(\text{RTB})$
Percentage interest sensitivity = $(\delta(\Delta\text{deposits})/\delta(\text{RTB}))/(100/\text{mean}(\Delta\text{deposits}))$

Notes, notation, variable definitions: Section 4.7.

Next in line are Florida and Ohio with similar elasticities. The small states are a class by themselves with New Mexico a distant last.

Since the T-bill rate is quite volatile (the coefficient of variation calculated between 1969 and 1975 is 24 percent, for example) I felt that a measure of the effect of a 100 basis point rise in this rate would give a better idea of the impact of changes in market rates. As shown, the resulting reductions in deposit flows range from $ 500 million for California to $ 3 million for Idaho.

The third measure of interest sensitivity compares the reduction in deposit flows following a 100 basis point rise in T-bill rate to the average deposit flow. Figure 4.1 showed, of course, that significantly larger fluctuations occurred during the sample period.

The next coefficient to be analyzed is the coefficient associated with SA2L, the lagged stock of deposits deflated by income. As developed in chapter 3, the negative of the estimated coefficient is the estimated speed of adjustment. The differences and similarities between the states are readily apparent from Table 4.3. A speed of adjustment of 19 percent per quarter for California implying total adjustment within about five quarters appears very reasonable. The relative ranking of the states conforms with the a priori expectations of chapter 3. In my opinion, these results compare quite favorably with some studies of national aggregates where unbelievably low speeds of adjustments of about 4 percent are reported (Silber 1970, Fortune 1972).

Summarizing the just presented results, I reach the following conclusion: There is a significant variation in the demand for savings and loan deposits across states. Among the sample states, California S&L depositors are the most sensitive to changes in opportunity costs and adjust their holdings of S&L deposits very rapidly in response to changes in the determinants of the demand for deposit flows. S&Ls in Florida and Ohio are affected in very much the same way by changes in open market yields. It should be noted, however, that this does not imply that the effect on the Florida economy would be the same. In fact, if it can be shown in the remainder of the study that there is a direct relationship between S&L deposit flows and residential construction activity, the Florida residential construction sector is likely to be hit much harder by rising market rates than Ohio's residential construction sector. This conclusion can be derived from the marginal interest sensitivity reported in Table 4.4 combined with the deposit-income ratio shown in Table 4.1. Because Florida S&Ls hold such a large share of the deposit market, Florida's marginal interest sensitivity exceeds Ohio's by 50 percent even though Florida state personal income is nearly 30 percent lower than Ohio state personal income (mean 69:1 to 75:4).

Savings and loan associations in the small sample states are more insulated from national money market conditions. In addition, their depositors react more slowly to changes in the general determinants of deposit flows which provides an additional element of stability.

Since no state income data are available which are compatible with the semi-annual bank call report data, it was not possible to estimate demand equations for bank deposits. Quite astounding regional differences can be detected, however, by regressing the demand deposit-total deposit ratio (DD / (DD + TD)) on time and a seasonal dummy variable. The plots of the actual and fitted values for California, Florida, and South Carolina are shown in Figures 4.2, 4.3, and 4.4.

Figure 4.2 shows that demand deposits at California commercial banks accounted for 42 percent of total deposits at year end 1966. This proportion declined rather steadily to 35 percent by June, 1975. The largest residuals occur in 69:12 and 70:6 when California banks were exposed to severe disintermediation. Time deposits fell from $ 26.4 billion in December, 1968 to $ 23.5 billion in December, 1969.

Figure 4.3 depicts the situation for Florida. At year end 1966, 57 percent of total deposits were demand deposits. By June 1975 this proportion had been reduced to 42 percent, exactly the same share as in California at the

```
ID      ACTUAL      FITTED      RESIDUAL

6612    0.4203      0.4411      -0.208E-01
6706    0.4002      0.4262      -0.260E-01
6712    0.4240      0.4337      -0.974E-02
6806    0.4104      0.4189      -0.853E-02
6812    0.4184      0.4264      -0.804E-02
6906    0.4264      0.4116       0.149E-01
6912    0.4595      0.4191       0.404E-01
7006    0.4392      0.4042       0.350E-01
7012    0.4197      0.4118       0.797E-02
7106    0.4027      0.3969       0.576E-02
7112    0.4000      0.4044      -0.445E-02
7206    0.3973      0.3896       0.768E-02
7212    0.4153      0.3971       0.182E-01
7306    0.3765      0.3823      -0.576E-02
7312    0.3961      0.3898       0.630E-02
7406    0.3636      0.3749      -0.113E-01
7412    0.3525      0.3824      -0.299E-01
7506    0.3560      0.3676      -0.116E-01
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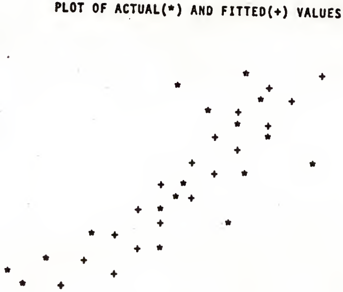


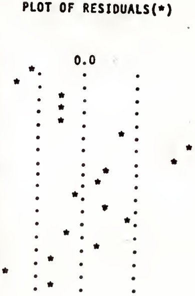
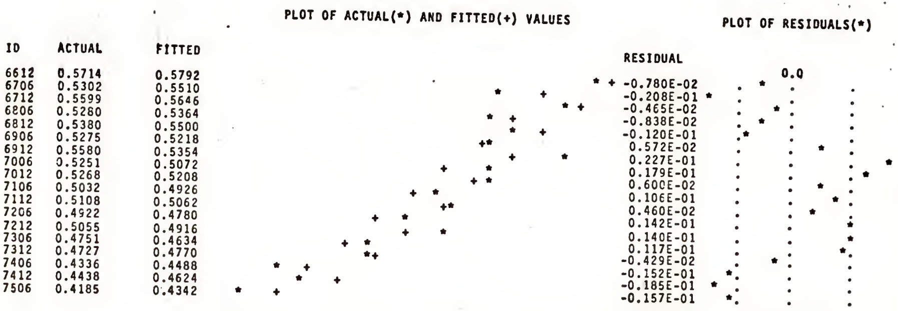


Figure 4.2 - California Commercial Banks, Demand Deposits as a Proportion of Total Deposits



```
                              PLOT OF ACTUAL(*) AND FITTED(+) VALUES          PLOT OF RESIDUALS(*)
ID     ACTUAL     FITTED                                           RESIDUAL
                                                                                      0.0
6612   0.5714     0.5792                                         -0.780E-02
6706   0.5302     0.5510                                         -0.208E-01
6712   0.5599     0.5646                                         -0.465E-02
6806   0.5280     0.5364                                         -0.838E-02
6812   0.5380     0.5500                                         -0.120E-01
6906   0.5275     0.5218                                          0.572E-02
6912   0.5580     0.5354                                          0.227E-01
7006   0.5251     0.5072                                          0.179E-01
7012   0.5268     0.5208                                          0.600E-02
7106   0.5032     0.4926                                          0.106E-01
7112   0.5108     0.5062                                          0.460E-02
7206   0.4922     0.4780                                          0.142E-01
7212   0.5055     0.4916                                          0.140E-01
7306   0.4751     0.4634                                          0.117E-01
7312   0.4727     0.4770                                         -0.429E-02
7406   0.4336     0.4488                                         -0.152E-01
7412   0.4438     0.4624                                         -0.185E-01
7506   0.4185     0.4342                                         -0.157E-01
```

Figure 4.3 - Florida Commercial Banks, Demand Deposits as a Proportion of Total Deposits

```
                                PLOT OF ACTUAL(*) AND FITTED(+) VALUES                      PLOT OF RESIDUALS(*)
ID     ACTUAL      FITTED
                                                                             RESIDUAL
6612   0.7505      0.7417                                                    0.877E-02
6706   0.7127      0.7134                                                   -0.626E-03
6712   0.7306      0.7208                                                    0.981E-02
6806   0.6889      0.6925                                                   -0.355E-02
6812   0.6912      0.6999                                                   -0.876E-02
6906   0.6623      0.6716                                                   -0.927E-02
6912   0.6763      0.6791                                                   -0.275E-02
7006   0.6548      0.6507                                                    0.403E-02
7012   0.6623      0.6582                                                    0.406E-02
7106   0.6297      0.6299                                                   -0.178E-03
7112   0.6290      0.6373                                                   -0.828E-02
7206   0.6052      0.6090                                                   -0.382E-02
7212   0.6188      0.6164                                                    0.233E-02
7306   0.5938      0.5881                                                    0.569E-02
7312   0.5978      0.5956                                                    0.229E-02
7406   0.5624      0.5672                                                   -0.479E-02
7412   0.5672      0.5747                                                   -0.747E-02
7506   0.5589      0.5463                                                    0.125E-01
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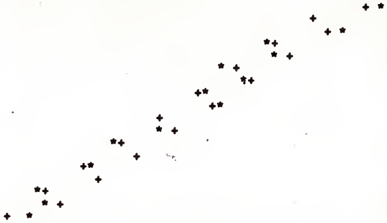

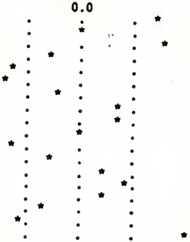

Figure 4.4 - South Carolina Commercial Banks, Demand Deposits as a Proportion of Total Deposits

beginning of the sample period. It seems quite clear that California investors were much more interest conscious already in the early sixties and adjusted their liquid assets accordingly. It seems equally clear that bank asset management would be heavily influenced by the composition of a bank's liabilities and particularly by drastic shifts in that composition as in the case of Florida. In contrast to California, disintermediation appears not to have been a very serious problem for Florida banks.

Ohio banks experienced a very similar shift in deposit composition as Florida banks. During the same time span, their demand deposit fraction dropped from 48 percent to 35 percent, an adjustment of 13 percent compared to Florida's 15 percent.

South Carolina, Figure 4.4, is representative for the small states, where the adjustment was most dramatic. With no disintermediation discernible, demand deposits declined steadily from 75 percent to 55 percent.

In summary, the deposit composition of commercial banks displays wide variation across states. "Sophisticated" California investors had already managed to reduce the proportion of demand deposits to 42 percent by 1966 and cut it a further 7 percent by 1975. The other side of the coin is, of course, that California banks were most likely faced with a higher cost of funds than banks in Florida or South Carolina. In Ohio, Florida, and the smaller states, investors apparently also became more interest conscious and shifted funds into higher yielding liquid assets. The most rapid adjustment took place in South Carolina, although they still have about 20 percent to go until they reach the current levels of California and Ohio. How these substantial changes affected bank portfolio behavior will be investigated in section 4.5.

4.4 The Portfolio Behavior of Savings and Loan Associations

In the framework developed in chapter 3, the focus of an examination of S&L portfolio behavior has to be on their two main decision variables, mortgage lending and borrowing from the Federal Home Loan Bank System. Therefore, the first part of this section will be devoted to a detailed analysis of the demand equation for mortgages and its arguments. After this, S&L borrowing behavior will be examined.

The estimated demand equation for mortgage flows corresponds very closely to the theoretical model, and the final version of the gross mortgage acquisitions equation is of the following form:

$$S2A = b_1 * S1L + b_2 * S1F + b_3 * S2L + b_4 * S4L + b_5 * S5 + b_0$$

where: S2A = gross mortgage acquisitions (Δmortgages + repayments);

S1L = deposits(-1), adj. for liquidity requirements;

S1F = Δdeposits, adj.;

S2L = mortgages(-1);

S4L = commitments(-1); and

S5 = mortgage repayments.

The estimation results are reported in Table 4.5.

Somewhat surprisingly all the interest rate variables turned out to be insignificant. With respect to the Government bond rate, the conclusion is that S&Ls do not consider Government bonds as substitutes for mortgages. They represent a very small fraction of total assets and are simply held to meet the legal liquidity requirements. The effects of the mortgage rate and the rate charged on FHLB advances are to some extent captured by the commitment variable as will be shown below.

Federal Home Loan Bank advances were expected to have a positive effect on mortgage acquisitions. Presumably because of their high collinearity with deposit flows they

Table 4.5 - Savings and Loan Associations Gross Mortgage Acquisitions, Estimated Coefficients

	S1L $(x10^{-1})$	S1F $(x10^{-1})$	S2L $(x10^{-1})$	S4L $(x10^{-1})$	S5	Constant $(x10^{-1})$	Mean $(x10^{-1})$	R^2	DW	SE $(x10^{-1})$	ρ
CA	3.58	2.14	-3.48	3.27	1.29	13.1	17.39	.983	1.74	1.02	.65
	(4.4)	(5.7)	(5.3)	(1.9)	(3.35)	(3.1)					
FL	2.87	1.64	-3.21	5.03	1.92	1.76	8.16	.977	1.94	.550	.47
	(3.8)	(1.6)	(4.5)	(4.6)	(2.6)	(1.5)					
OH	.931	2.54	-1.15	2.26	1.98	-.242	8.27	.969	1.77	.503	
	(.8)	(1.7)	(1.0)	(.9)	(3.5)	(.2)					
SC	3.52	1.99	-3.40	7.28	1.49	.0148	1.19	.991	2.00	.0526	
	(6.6)	(3.1)	(7.4)	(5.7)	(4.5)	(.3)					
NM	2.92	-	-3.04	8.73	1.76	-.030	.361	.973	1.65	.0320	
	(3.1)		(3.5)	(5.2)	(5.9)	(1.0)					
IO	4.13	7.87	-4.61	11.85	2.16	0.110	.197	.969	2.19	.0192	
	(6.7)	(5.5)	(7.1)	(5.2)	(8.3)	(4.1)					

Notes, notation, variable definitions: Section 4.7.

failed to be statistically significant and the estimated coefficient often had the wrong sign. In order to be able to compare S&L behavior with respect to this important variable, a separate equation was estimated. Those results will be discussed later.

Before turning to the analysis of the individual variables, some general remarks about the results reported in Table 4.5 are in order. With the exception of the Ohio equation, all the variables are highly significant and the coefficients have the expected signs. The fit of the equations would have to be considered good for any flow equation but may be called remarkable bearing in mind the two truly extraordinary contractions in mortgage activity during the sample period. (Figure 4.5 illustrates this point.) The standard error of the equation equals about 0.4 percent of the stock of mortgages on the average.

The individual variables reveal the following picture. The coefficients of S1L and S2L are of the same order of magnitude and simply reflect liquidity effects. That is, if mortgage holdings rise relative to deposits, acquisitions have to be reduced and vice versa. The size of the coefficient indicates how rapidly the adjustment takes place. Disregarding Idaho because all the growth in that state took place in 1975, the speeds of adjustment range from .35 for California to .12 for Ohio. It appears that the faster growing

```
ID      ACTUAL        FITTED            RESIDUAL
6901    0.7526E-01    0.6942E-01        0.584E-02
6902    0.6499E-01    0.6036E-01        0.463E-02
6903    0.4871E-01    0.4959E-01       -0.889E-03
6904    0.5628E-01    0.5538E-01        0.901E-03
7001    0.4936E-01    0.4779E-01        0.157E-02
7002    0.3801E-01    0.4142E-01       -0.342E-02
7003    0.5232E-01    0.5888E-01       -0.656E-02
7004    0.7556E-01    0.7415E-01        0.141E-02
7101    0.8961E-01    0.9280E-01       -0.319E-02
7102    0.1055        0.1108           -0.538E-02
7103    0.1309        0.1271            0.373E-02
7104    0.1375        0.1338            0.361E-02
7201    0.1394        0.1439           -0.451E-02
7202    0.1471        0.1492           -0.213E-02
7203    0.1673        0.1674           -0.112E-03
7204    0.1864        0.1822            0.418E-02
7301    0.1814        0.1878           -0.633E-02
7302    0.1830        0.1789            0.412E-02
7303    0.1612        0.1540            0.723E-02
7304    0.9708E-01    0.1050           -0.794E-02
7401    0.1112        0.1146           -0.339E-02
7402    0.1371        0.1318            0.534E-02
7403    0.1159        0.1136            0.234E-02
7404    0.1099        0.1159           -0.598E-02
7501    0.1240        0.1202            0.385E-02
7502    0.1505        0.1447            0.582E-02
7503    0.1883        0.1847            0.360E-02
7504    0.2158        0.2241           -0.833E-02
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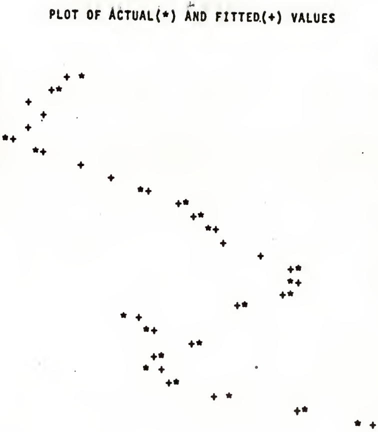


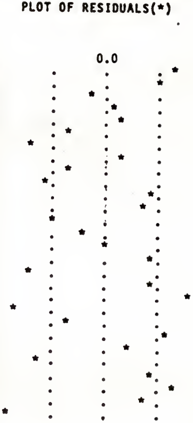


Figure 4.5 - South Carolina Savings and Loan Associations, Mortgage Acquisitions

states kept their liquidity at a minimum and therefore had to react very quickly to changes in deposits.

The flow variables S1F and S5 are highly significant and confirm that S&L managers adjust their mortgage holdings very rapidly in response to changes in the flows of loanable funds. The coefficient of S5 is greater than 1 because the dependent variable is gross mortgage acquisitions (includes repayments). The coefficient is often close to 2 because repayments are relatively easy to predict in most of the states. The coefficient of S5 Idaho is too large, however, and can only be explained by the special circumstances in this state at the end of the sample period. The same interpretation applies to the coefficient of S4 Idaho.

With the exception of Ohio, commitments (S4L) are an important explanatory variable in the mortgage acquisition equation and play the role outlined in chapter 3. The discussion of the commitments equation will offer an explanation why S4L Ohio should be expected to be insignificant.

In summary, it was found that the main determinants of the demand for mortgages by savings and loan associations are not relative interest rates but the level and variability of their deposits in combination with outstanding mortgage commitments.

The estimation results for the mortgage commitments equation are reported in Table 4.6. Unfortunately, data gaps made it impossible to break the commitment process down into the estimation of new commitments and the takedown ratio as developed in chapter 3. The Federal Home Loan Bank Board suspended the collection of new mortgage commitments data from January, 1973 to December,1975. Since this was a very critical period for this study, it was deemed inappropriate to construct the missing data. Instead, I used a reduced form approach and estimated the level of commitments outstanding for which a complete time series was available.

The estimated equation was of the following form:

$$S4 = b_1 * S4L + b_2 * S5 + b_3 * S1F + b_4 * RMS1 + b_5 * RFS1 + b_0$$

where: S4 = mortgage commitments outstanding;
S4L = S4(-1);
S5 = repayments;
S1F = Δdeposits;
RMS1 = mortgage rate * deposit(-1); and
RFS1 = advance rate * deposits(-1).

Table 4.6 - Savings and Loan Associations Commitments Outstanding, Estimated Coefficients

	S4L $(x10^{-1})$	S5 $(x10^{-1})$	S1F $(x10^{-1})$	RMS1 $(x10^{-3})$	RFS1 $(x10^{-3})$	Constant	Mean $(x10^{-1})$	R^2	SE $(x10^{-1})$
CA	8.99	.200	2.12	1.73	-1.94	-	12.9	.979	1.09
	(17.3)	(.2)	(5.9)	(.6)	(.7)				
FL	9.25	2.53	3.38	6.79	-9.65	-	8.49	.986	.589
	(20.5)	(1.1)	(4.5)	(1.5)	(2.0)				
OH	6.33	2.54	2.99	3.65	-4.64	-	4.68	.958	.371
	(6.9)	(1.7)	(4.2)	(1.3)	(1.6)				
SC	3.47	9.21	2.77	-.557	-1.16	-.0083	.566	.939	.077
	(2.0)	(2.2)	(3.2)	(.14)	(.29)	(1.2)			
NM	5.61	4.91	-	10.5	-9.64	-.00694	.219	.954	.0262
	(3.7)	(2.0)		(2.0)	(1.7)	(2.2)			
IO	4.09	1.03	2.10	5.47	-6.16	-	.0501	.668	.0157
	(2.2)	(.5)	(2.0)	(1.3)	(1.4)				

Notes, notation, variable definitions: Section 4.7.

Again, the general model of portfolio behavior with deposits as scale variable proves to be a very convenient tool for the explanation of the mortgage commitment process. With the exception of Idaho whose special situation was explained above, the equations fit the data quite well and bring out the regional similarities and differences. As observed before, interest rate variables have only limited explanatory power for S&L portfolio behavior. They were retained here in order to demonstrate their low statistical significance.

By far the most important variable for marginal adjustments are current deposit flows. The relative sizes of the t statistics of this coefficient clearly reflect S&L managers' perception of different investor interest sensitivities demonstrated in section 2.3. A point in case is New Mexico where S1F was totally insignificant in the commitment equation as well as in the just discussed mortgage acquisitions equation. This had to be anticipated because New Mexico investors were shown to be the least interest sensitive in Table 4.2.

As expected, the relatively stable repayments are not very important in the commitment process where dynamic factors have priority.

The coefficient associated with S4L is in every state highly significant. I believe, however, that it should not be used to derive the speed of adjustment which would usually be 1 minus this coefficient. S&Ls in the interest sensitive states may have a tendency to issue only relatively short-term commitments.This may have the effect that a relatively high percentage of the new commitments is taken down during the same quarter. S4L would then only capture the residuals and the speed of adjustment would be seriously biased downward.

An interesting institutional feature can be detected when comparing the means of commitments outstanding for Florida and Ohio. Although the S&L industries in the two states are very similar in most respects,commitments are nearly twice as important in Florida as in Ohio. This has to do with the fact that the bulk of mortgage loan commitments issued are "commitments to originate", that is, for new mortgage loans. Clearly, in a growth state like Florida (Table 4.1) mortgage activity in the primary market is more important than in a "mature" state like Ohio, where secondary market activity is relatively more important. This explains the just discussed results for the mortgage acquisitions equation and will also be shown to be of importance in the repayments equation, to be discussed next.

The last determinant of S&L mortgage demand that must be analyzed are mortgage loan repayments. The estimated equation corresponds exactly to the theoretical model.

$$S5 = b_1 * S2L + b_2 * S2F + b_3 * RDIF + b_0$$

where: S5 = repayments;

S2L = mortgages(-1);

S2F = Δmortgages; and

RDIF = current mortgage rate minus average of past mortgage rates (scaled by mortgages outstanding).

The estimation results are reported in Table 4.7.

They display surprisingly little regional variation and the interpretation is relatively straightforward. The proportion of mean repayments to mean mortgages outstanding (Table 4.1) is roughly the same for all states with the exception of Ohio where it is significantly higher. Part of the explanation for this was given in the preceding paragraph. Ohio S&Ls experienced lower growth and therefore hold a mortgage portfolio with a different age structure. This is captured by the coefficient of S2L which says that normal mortgage repayments amount to about 2.5 percent per quarter of the mortgage stock. In the fastest growing state, Florida, only about 1.4 percent were repaid quarterly. In view of the fact that nearly all of Idaho's growth must be attributed

Table 4.7 - Savings and Loan Associations Loan Repayments, Estimated Coefficients

	S2L ($x10^{-2}$)	S2F ($x10^{-1}$)	RDIF ($x10^{-3}$)	Constant ($x10^{-2}$)	Mean ($x10^{-1}$)	R^2	DW	SE ($x10^{-1}$)	ρ
CA	2.03	2.60	-2.86	-	9.02	.954	1.94	.564	.54
	(13.5)	(5.4)	(2.1)						
FL	1.39	2.02	-1.64	7.19	3.30	.976	1.63	.155	-
	(17.2)	(14.2)	(2.7)	(8.1)					
OH	2.46	4.13	-1.94	6.75	5.08	.955	2.23	.266	.51
	(6.0)	(6.8)	(1.2)	(1.4)					
SC	1.58	3.42	-1.63	.635	.581	.968	1.63	.0335	.31
	(6.0)	(8.4)	(1.2)	(1.7)					
NM	1.68	1.45	-3.12	.439	.162	.899	1.89	.0183	.66
	(2.5)	(2.1)	(1.1)	(1.2)					
IO	4.32	.396	-2.15	-.439	.100	.885	1.71	.0122	.62
	(5.5)	(4.1)	(2.3)	(1.5)					

Notes, notation, variable definitions: Section 4.7.

to the year 1975, a large coefficient may be expected. 4.3 percent per quarter appears unreasonably high, however, and probably incorporates some of the effect of the closely related variable S2F.

S2F as a proxy for real estate activity is highly significant in every state. The relative sizes of the coefficients are very plausible. In a "mature" state like Ohio the secondary housing market is relatively more important than in a growth state like Florida. Therefore, more real estate transactions give rise to repayments (refinancing) in Ohio. The coefficient of the interest differential variable has the correct sign in all states but is statistically only significant in California, Florida, and Idaho. Although not too much importance should be attached to this constructed variable, the estimation results seem to confirm the earlier findings about relative interest sensitivities in the various states.

The final equation to be discussed for the savings and loan industry is the demand for Federal Home Loan Bank advances. The estimated equation was of the following form in accordance with the model developed in chapter 3.

$$S3 = b_1 * S3L + b_2\ S3SY + b_3\ S2L + b_4 * S1L + b_5 * S1F + b_0$$

where: S3 = FHLB advances to the S&Ls of a particular state;

S3L = S3(-1);

S3SY = total advances of the FHLB System (scaled by state deposits);

S2L = mortgages(-1);

S1L = deposits(-1); and

S1F = Δdeposits.

The estimation results are reported in Table 4.8 and can be interpreted as follows. In none of the states were interest rate variables statistically significant which is in line with earlier findings that quantity appears to be more important than price in the savings and loan mortgage market. In the same vein, the results suggest that Federal Home Loan Bank System policy on advances is more appropriately viewed as being made in terms of quantity of advances than in terms of the rate charged. This latter conclusion must be regarded as tentative, however, since it is based on average interest rates for the whole FHLB System. The more appropriate interest rates charged by the individual Federal Home Loan District Banks were not available for the whole sample period but they appear to vary significantly. For

Table 4.8 - Savings and Loan Associations FHLB Advances, Estimated Coefficients

	S3L $(x10^{-1})$	S3SY $(x10^{-3})$	S2L $(x10^{-1})$	S1L $(x10^{-1})$	S1F $(x10^{-1})$	Constant	Mean $(x10^{-1})$	R^2	SE $(x10^{-1})$
CA	1.87	6.06	1.41	-2.89	-2.08	4.43	35.5	.980	1.72
	(1.7)	(5.7)	(2.1)	(4.0)	(3.1)	(5.4)			
FL	1.69	2.47	1.69	-1.62	-1.44	-.085	4.57	.993	.404
	(1.3)	(3.0)	(5.5)	(4.6)	(1.8)	(1.7)			
OH	3.18	2.54	.868	-1.16	-	.233	5.40	.987	.362
	(2.9)	(4.6)	(1.6)	(2.2)		(2.4)			
SC	-	2.32	3.03	-2.97	-3.00	-	.890	.986	.0627
		(14.4)	(6.1)	(5.5)	(4.1)				
NM	7.22	.189	1.14	-.935	-1.66	-.0036	.184	.978	.0179
	(8.5)	(.4)	(2.5)	(2.1)	(2.5)	(.9)			
IO	-	-	2.21	-1.73	-.208	-.0078	.0926	.876	.0117
			(5.3)	(5.0)	(.2)	(3.3)			

Notes, notation, variable definitions: Section 4.7.

December, 1973, for example, the FHLB of Atlanta reports a weighted average rate on advances outstanding of 8.30 percent. At the same time, the corresponding rate for the FHLB of Topeka was 6.83 percent, which amounts to an astounding spread of 1.47 percent within the FHLB System.

Another problem complicating the interpretation of the estimation results is that among the sample states only California S&Ls made extensive use of FHLB System credit during the 1969/70 "crunch". Figure 4.6 illustrates the behavior of California S&Ls and Figure 4.7 is representative for the completely different pattern of the other five sample states.

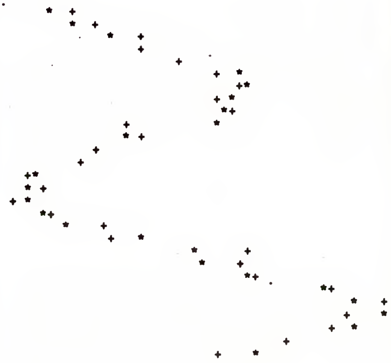
Bearing in mind these two caveats, one can classify the sample states into three groups according to the estimation results in Table 4.8.

New Mexico and Idaho borrow occasionally to even out fluctuations in the deposit-mortgage ratio. New Mexico also borrows in response to shifts in deposit flows but the borrowing needs of neither state coincide directly with the lending cycle of the FHLB System.

Florida, Ohio, and South Carolina display very similar patterns. Proportionately to the level of their deposits they make use of FHLB credit to the same extent and for the same reasons. Current deposit flows are not significant for Ohio, however, possibly because they have fewer

```
ID      ACTUAL      FITTED      RESIDUAL
6901    2.105       2.420       -0.315
6902    2.376       2.589       -0.212
6903    2.754       3.072       -0.318
6904    3.058       3.111       -0.539E-01
7001    3.493       3.471        0.218E-01
7002    4.156       3.865        0.290
7003    4.242       4.107        0.135
7004    4.076       3.873        0.203
7101    3.942       4.086       -0.144
7102    3.861       2.966        0.895
7103    2.915       3.068       -0.153
7104    2.657       2.653        0.409E-02
7201    2.492       2.429        0.630E-01
7202    1.978       1.906        0.718E-01
7203    1.940       2.060       -0.120
7204    1.937       1.745        0.192
7301    2.070       2.106       -0.363E-01
7302    2.288       2.691       -0.403
7303    3.086       2.761        0.325
7304    3.614       4.177       -0.563
7401    3.757       4.126       -0.369
7402    4.177       4.311       -0.134
7403    5.015       5.086       -0.717E-01
7404    5.355       5.640       -0.286
7501    5.619       5.213        0.406
7502    5.349       5.080        0.269
7503    4.577       4.645       -0.679E-01
7504    4.301       3.931        0.370
```

PLOT OF ACTUAL(*) AND FITTED(+) VALUES



PLOT OF RESIDUALS(*)

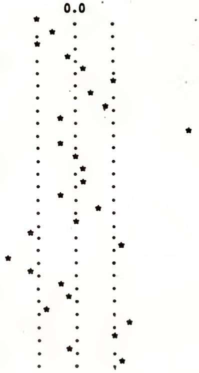


Figure 4.6 - California Savings and Loan Associations, Federal Home Loan Bank Advances

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                                PLOT OF ACTUAL(*) AND FITTED(+) VALUES                PLOT OF RESIDUALS(*)

ID      ACTUAL        FITTED                                                  RESIDUAL
                                                                                            0.0
6901    0.3815E-01   -0.3420E-01                                               0.723E-01
6902    0.4390E-01    0.2847E-03                                               0.436E-01
6903    0.6360E-01    0.8084E-01                                              -0.172E-01
6904    0.9641E-01    0.9577E-01                                               0.640E-03
7001    0.1530        0.1196                                                   0.334E-01
7002    0.2076        0.2145                                                  -0.691E-02
7003    0.2092        0.2368                                                  -0.276E-01
7004    0.1897        0.2334                                                  -0.437E-01
7101    0.1747        0.3114                                                  -0.137
7102    0.1766        0.6867E-01                                               0.108
7103    0.1036        0.1352                                                  -0.315E-01
7104    0.9864E-01    0.1380                                                  -0.394E-01
7201    0.1171        0.9199E-01                                               0.251E-01
7202    0.1224        0.6306E-01                                               0.593E-01
7203    0.1368        0.1021                                                   0.347E-01
7204    0.1440        0.1335                                                   0.104E-01
7301    0.1980        0.2228                                                  -0.248E-01
7302    0.2511        0.3333                                                  -0.822E-01
7303    0.5012        0.5471                                                  -0.459E-01
7304    0.6758        0.6222                                                   0.536E-01
7401    0.7043        0.7821                                                  -0.778E-01
7402    0.7568        0.8370                                                  -0.801E-01
7403      1.043         1.032                                                  0.113E-01
7404      1.232         1.213                                                  0.190E-01
7501      1.293         1.198                                                  0.953E-01
7502      1.173         1.106                                                  0.666E-01
7503      1.062         1.053                                                  0.881E-02
7504    0.9456        0.9737                                                  -0.281E-01
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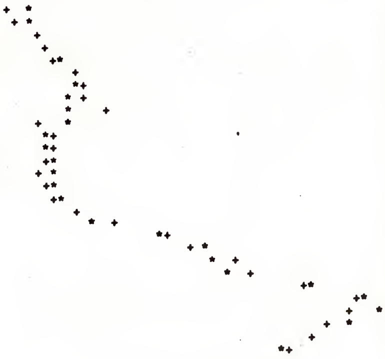

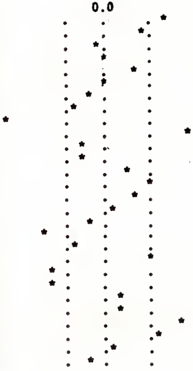

Figure 4.7 - Florida Savings and Loan Associations, Federal Home Loan Bank Advances

funds tied up through the mechanism of advance commitments. In line with this, Ohio's speed of adjustment is lower than Florida's. No speed of adjustment can be calculated for South Carolina because the high degree of collinearity between S3L and S3SY rendered S3L insignificant.

California S&Ls stand out in that they borrow much more aggressively than the just mentioned three states. This can be seen from the coefficients of S3SY (6 vs. 2.5) which would otherwise be of the same order of magnitude since this variable is scaled by state deposits.

Since FHLB advances are intended to stabilize the flows of loanable funds to S&Ls, it is interesting to analyze this stabilizing effect by state. This can be done by comparing the coefficient of S3SY with the percentage interest sensitivity given in Table 4.4. It is evident that California S&Ls managed to dampen their swings in deposit flows relatively better than Florida, Ohio, and South Carolina. New Mexico and Idaho, on the other hand, were less successful in stabilizing their flows of loanable funds than these three states.

4.5 Portfolio Behavior of Commercial Banks

The model developed in chapter 3 requires the estimation of demand equations for "local" financial assets and a comparison across states of the degree of substitution between these assets and financial assets traded in national markets. The focus should be on commercial loans and on mortgage loans.

When I attempted to estimate demand equations for commercial loans for the various states, it became clear that no meaningful results could be obtained by treating the flow of commercial loans as a decision variable. All the interest rate variables used as explanatory variables turned out to be statistically insignificant. This was the case for national interest rate series of competing assets as well as for the "own" rate. As an own rate I used the regional rates on business loans of banks ($ 10,000 to 99,000) published in the Federal Reserve Bulletin. The conclusion seemed clear, even for semi-annual data, changes-in-loans cannot be viewed as a variable fully under bank control. Therefore, I decided to adopt an assumption that is usually made in quarterly models (Goldfeld 1966, Silber 1970), namely, that the "customer relationship" forces a bank to accept loan requests in the short-run. This has the effect that commercial loans enter a securities demand equation as a flow constraint.

The demand equation for Government securities developed in chapter 3 but incorporating the above modification, was therefore estimated in the following form:

$$B1 = b_1 * B1L + b_2 * B67 + b_3 * B4 + b_5 * TIME + b_6 * DUM + b_0$$

where: B1 = Government securities holdings/total deposits;

B1L = B1(-1);

B67 = demand deposits/time deposits;

B4 = commercial loans/total deposits;

TIME = time trend; and

DUM = seasonal dummy variable.

The chosen form reflects the need to preserve degrees of freedom. The data were not seasonally adjusted, no first-differenced variables were used, and TIME has to represent such variables as increased activity in the Federal funds market, negotiable CDs outstanding, etc. Since I was not interested in the separate effects of changes in demand deposits and time deposits, I created the single deposit composition variable B67 which would yield essentially the same information.

The estimation results are presented in Table 4.9. Taking into consideration that the observations are semi-annual call reports, the relatively simple specification fits the data rather well.

Table 4.9 - Commercial Banks U.S. Government Securities Holdings, Estimated Coefficients

	B1L	B67	B4	TIME	DUM	CONSTANT	MEAN	R^2	SE
				$(x10^{-2})$	$(x10^{-2})$				$(x1-^{-2})$
CA	-	-	-.684	-.214	-.712	.296	.093	.871	.687
			(5.6)	(6.8)	(2.2)	(9.5)			
FL	-	-.114	-1.50	-1.09	-	.618	.149	.960	.965
		(2.7)	(4.2)	(9.3)		(7.4)			
OH	.188	.143	-1.03	-	.627	.204	.143	.973	.566
	(1.4)	(3.6)	(6.4)		(1.4)	(5.5)			
SC	.766	.0194	-.0375	-	-	.00382	.113	.974	.726
	(7.1)	(1.9)	(.2)			(.1)			
NM	.426	.0888	-.431	-	-	.0785	.130	.962	.896
	(1.9)	(2.2)	(1.2)			(.9)			
IO	-	-	-.156	-.515	-.971	.197	.109	.910	1.05
			(.3)	(4.2)	(1.9)	(3.4)			

Notes, notation, variable definitions: Section 4.7.

The commercial loan variable is highly significant in the group of large states. Its coefficient is of the right sign in the small states but in every case statistically insignificant. Given that loan demand is treated as an exogenous variable, it is logically not permissible to conclude that commercial loans are substitutes for Government securities. Nevertheless, it appears to me that the strong inverse relationship between the portfolio share of Governments and the portfolio share of commercial loans showing up in semi-annual data may be regarded as an indication that there exists in fact a higher degree of substitution in the first group of states than in the second group.

The coefficient of B67 simply indicates that banks increase their holdings of Government securities when demand deposits rise relative to time deposits. The coefficient for Florida is negative because the variable TIME has the effect of detrending all the variables in the equation. Once B67 is detrended, however, the ratio goes up during periods of disintermediation as shown in section 4.3. At the same time securities must be sold in order to match the outflow of funds and this results in an inverse relationship between B1 and B67.

In summary, it must be noted that the theoretical portfolio behavior model could not be applied to the demand for commercial loans. The model was applied to the demand for Government securities, the most likely substitute for commercial loans, but the results proved to be inconclusive with respect to the question of regional differences in the degree of substitutability between these two investments. Figures4.8 - 4.11 may yield some insight, however.

For Figures 4.8 and 4.9 Government securities holdings divided by total deposits were regressed on TIME. Figure 4.8 reveals a very clear cyclical pattern, with a slight overall drop in the Government securities share from 11 percent in 1967 to 9 percent in 1975. Figure 4.9, representative for all other states in the sample, is all trend with a reduction in Government securities holdings from 21 percent to 12 percent. The resemblance between these two figures and Figures 4.2 and 4.3 (demand deposits as a proportion of time deposits) is striking.

In contrast, Figures 4.10 and 4.11 show the plot of the regression of commercial loans (divided by deposits) on TIME. Again, Figure 4.11 is representative for all other sample states. Despite dramatic shifts in the deposit composition, the portfolio share of commercial loans fluctuated very little around a "target" ratio. Before drawing any further conclusions, I will discuss the empirical results with respect to mortgage loans.

```
PLOT OF ACTUAL(*) AND FITTED(+) VALUES                PLOT OF RESIDUALS(*)

ID     ACTUAL        FITTED           RESIDUAL

6612   0.1175        0.1130           0.454E-02
6706   0.1070        0.1106          -0.362E-02
6712   0.1156        0.1082           0.736E-02
6806   0.1045        0.1058          -0.132E-02
6812   0.1129        0.1034           0.946E-02
6906   0.8218E-01    0.1010          -0.188E-01
6912   0.8910E-01    0.9864E-01      -0.954E-02
7006   0.8473E-01    0.9626E-01      -0.115E-01
7012   0.1003        0.9387E-01       0.639E-02
7106   0.9982E-01    0.9149E-01       0.833E-02
7112   0.1063        0.8910E-01       0.172E-01
7206   0.9214E-01    0.8671E-01       0.543E-02
7212   0.9443E-01    0.8433E-01       0.101E-01
7306   0.7264E-01    0.8194E-01      -0.930E-02
7312   0.6752E-01    0.7955E-01      -0.120E-01
7406   0.5838E-01    0.7717E-01      -0.188E-01
7412   0.7012E-01    0.7478E-01      -0.467E-02
7506   0.9321E-01    0.7240E-01       0.208E-01
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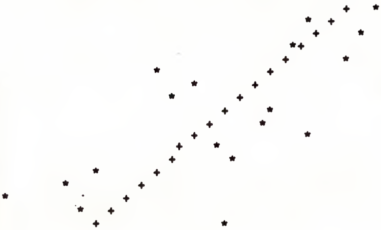


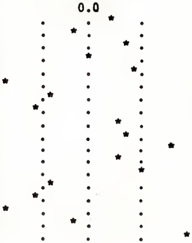


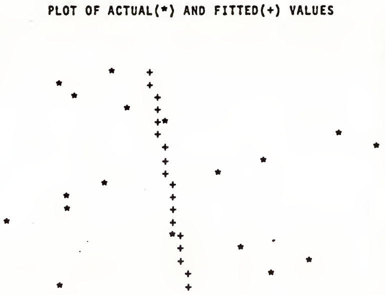
Figure 4.8 - California Commercial Banks, Government Securities Holdings

```
                                     PLOT OF ACTUAL(*) AND FITTED(+) VALUES                     PLOT OF RESIDUALS(*)

ID     ACTUAL       FITTED                                                         RESIDUAL
                                                                                                     0.0
6612   0.2123       0.2154                                                      *+ -0.310E-02   .    *.     .
6706   0.2106       0.2077                                                    +*    0.294E-02   .     .*    .
6712   0.2146       0.1999                                                 +     *  0.147E-01   .     .     *
6806   0.2103       0.1921                                              +      *    0.181E-01   .     .     . *
6812   0.1913       0.1844                                           +  *           0.699E-02   .     .  *  .
6906   0.1650       0.1766                                    *.   +               -0.116E-01   .*    .     .
6912   0.1522       0.1688                                *     +                  -0.166E-01  *.     .     .
7006   0.1464       0.1610                             *     +                     -0.147E-01   *     .     .
7012   0.1504       0.1533                               *+                        -0.289E-02   .    *.     .
7106   0.1480       0.1455                             +*                           0.255E-02   .     .*    .
7112   0.1398       0.1377                          +*                              0.211E-02   .     .*    .
7206   0.1295       0.1300                       +                                 -0.434E-03   .     *     .
7212   0.1233       0.1222                    +*                                    0.107E-02   .     *     .
7306   0.1048       0.1144              *   +                                      -0.965E-02   . *   .     .
7312   0.9394E-01   0.1067          *    +                                         -0.127E-01   .*    .     .
7406   0.8928E-01   0.9888E-01    *   +                                            -0.961E-02   . *   .     .
7412   0.8351E-01   0.9111E-01 *   +                                               -0.761E-02   .  *  .     .
7506   0.1237       0.8334E-01 +               *                                    0.403E-01   .     .     .          *
```

Figure 4.9 - Florida Commercial Banks, Government Securities Holdings

ID	ACTUAL	FITTED	RESIDUAL
6612	0.2499	0.2543	-0.434E-02
6706	0.2426	0.2545	-0.120E-01
6712	0.2451	0.2548	-0.966E-02
6806	0.2511	0.2550	-0.391E-02
6812	0.2561	0.2553	0.779E-03
6906	0.2778	0.2556	0.223E-01
6912	0.2822	0.2558	0.264E-01
7006	0.2680	0.2561	0.119E-01
7012	0.2627	0.2563	0.639E-02
7106	0.2484	0.2566	-0.818E-02
7112	0.2436	0.2568	-0.132E-01
7206	0.2437	0.2571	-0.134E-01
7212	0.2364	0.2574	-0.210E-01
7306	0.2571	0.2576	-0.500E-03
7312	0.2658	0.2579	0.791E-02
7406	0.2737	0.2581	0.155E-01
7412	0.2694	0.2584	0.110E-01
7506	0.2426	0.2587	-0.160E-01



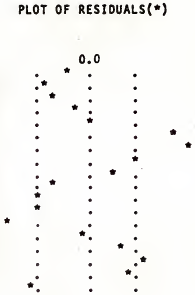
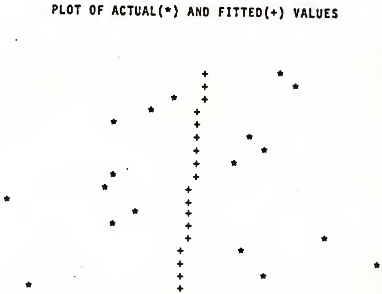


Figure 4.10 - California Commercial Banks, Commercial and Industrial Loans

```
ID      ACTUAL      FITTED
6612    0.1649      0.1600
6706    0.1658      0.1599
6712    0.1578      0.1598
6806    0.1564      0.1597
6812    0.1541      0.1596
6906    0.1630      0.1595
6912    0.1637      0.1595
7006    0.1618      0.1594
7012    0.1543      0.1593
7106    0.1534      0.1592
7112    0.1472      0.1591
7206    0.1554      0.1590
7212    0.1542      0.1589
7306    0.1678      0.1588
7312    0.1622      0.1587
7406    0.1713      0.1586
7412    0.1639      0.1586
7506    0.1489      0.1585
```



```
RESIDUAL
 0.489E-02
 0.591E-02
-0.199E-02
-0.330E-02
-0.554E-02
 0.348E-02
 0.425E-02
 0.248E-02
-0.502E-02
-0.576E-02
-0.119E-01
-0.363E-02
-0.476E-02
 0.899E-02
 0.350E-02
 0.126E-01
 0.530E-02
-0.957E-02
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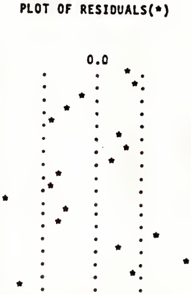


Figure 4.11 - Florida Commercial Banks, Commercial and Industrial Loans

Two equations were estimated in order to determine the degree of substitutability between mortgages and financial assets traded in national markets. Since the relatively long-term municipal bonds are an important component of bank portfolios and since the liquidity of their secondary market is less than the liquidity of the Governments market but certainly greater than the liquidity of the mortgage market, it was felt that they could be considered to be close substitutes for mortgages. Therefore, I estimated a demand equation for municipals with the municipals-mortgage yield spread as an argument. I also estimated a mortgage demand equation with the mortgage-municipals yield spread as an argument, in the hope of obtaining similar estimates for the yield spread variable.

The demand equation for municipal bonds corresponds to the standard formulation:

$$B2 = b_1 * B2L + b_2 * B67 + b_3 * RD2 + b_4 * DUM + b_0$$

where: B2 = municipals holdings/total deposits;

B2L = B2(-1);

B67 = demand deposits/time deposits;

RD2 = municipals yield - mortgage yield; and

DUM = seasonal dummy variable.

The estimation results are reported in Table 4.10.

Table 4.10 - Commercial Banks State-Local Bonds Holdings, Estimated Coefficients

	B2L	B67 ($x10^{-2}$)	RD2 ($x10^{-2}$)	DUM ($x10^{-2}$)	CONSTANT ($x10^{-1}$)	MEAN	R^2	SE ($x10^{-1}$)	ρ
CA	.745	6.45	.255	1.16	-.106	.115	.71	.109	
	(3.2)	(1.0)	(.3)	(1.5)	(.2)				
FL	.653	-.942	.179	1.47	.677	.167	.87	.105	
	(3.6)	(.2)	(.2)	(1.4)	(.7)				
OH	.237	-11.8	1.24	-	2.39	.168	.95	.033	
	(3.5)	(10.3)	(7.1)		(13.2)				
SC	.615	-1.31	1.52	-	1.19	.144	.85	.093	
	(4.5)	(1.9)	(3.2)		(3.6)				
NM	.662	-2.45	1.60	-.703	1.35	.140	.86	.069	-.59
	(5.0)	(1.7)	(3.8)	(.8)	(2.7)				
IO	.733	.540	.776	-	.571	.147	.83	.087	
	(5.8)	(.3)	(1.5)		(1.5)				

Notes, notation, variable definitions: Section 4.7.

In terms of goodness-of-fit the equations appear to do a reasonable job of explaining bank holdings of municipals. The crucial variable, RD2, is totally insignificant for California and Florida, however. The reason for this is that the nominal yield on municipals became increasingly meaningless in these two and possibly other states after banks incurred heavy loan losses and reported much lower earnings in the wake of the recession. Tax exempt income loses much of its attraction as soon as expenses exceed taxable income! This must be the explanation for the recent drastic reductions in municipals holdings. Unfortunately, it was not possible to calculate effective yields.

The demand equation for mortgages is frought with much the same problems.

$$B3 = b_1 * B3L + b_2 * B6 + b_3 * RD3 + b_4 * DUM + b_0$$

where: B3 = mortgage holdings/total deposits;
B3L = B3(-1);
B6 = demand deposits/total deposits;
RD3 = mortgage yield - yield on municipals;
DUM = seasonal dummy variable.

The regression results are reported in Table 4.11.

Table 4.11 – Commercial Banks Mortgage Loans, Estimated Coefficients

	B3L	B6 ($x10^{-1}$)	RD3 ($x10^{-2}$)	DUM ($x10^{-2}$)	CONSTANT	MEAN	R^2	SE ($x10^{-2}$)
CA	.480	1.65	1.28	1.33	.0	.209	.54	.765
	(2.4)	(1.6)	(2.0)	(2.6)	(.0)			
FL	.762	2.10	.273	1.60	-.0465	.137	.97	.539
	(3.2)	(1.3)	(.7)	(3.1)	(.5)			
OH	.680	-.275	.407	1.13	.0597	.198	.87	.500
	(2.8)	(1.1)	(1.0)	(2.3)	(.6)			
SC	.500	-1.48	1.09	1.15	.126	.129	.93	.646
	(2.9)	(2.4)	(2.2)	(3.1)	(2.3)			
NM	.407	-.698	.925	.511	.0720	.109	.87	.447
	(2.8)	(4.0)	(2.4)	(1.3)	(4.6)			
IO	.660	.036	1.07	1.44	.019	.165	.90	.445
	(5.6)	(.1)	(2.9)	(4.8)	(.8)			

Notes, notation, variable definitions: Section 4.7.

The general fit of the equation is also quite good, but not all of the individual variables are statistically significant.

I would like to discuss now some of the common features of the two equations (Table 4.10 and 4.11). According to the theory developed in chapter 3, the coefficients of the interest rate variables should be the same in both equations. For the reasons cited, California and Florida must be disregarded. All of the other states show the correct sign, but no two coefficients are the same. Given the quality of the data, this is not unanticipated. With the exception of Idaho, where B67 and B6 are insignificant, there is a clear negative relationship between the proportion of demand deposits and the proportion of long-term investments.

The coefficient of the lagged stock is always correctly signed and implies a relatively slow speed of adjustment. This conforms with a priori expectations for these relatively illiquid investments.

In summary, some substitutability has been found between mortgages and municipals but one cannot place too much confidence in these findings because it has not been possible to confirm them in a second equation. Not all of the required data are available and the available bank data by state are not rich enough.

Two more figures may shed some light on commercial bank mortgage activity. Mortgage holdings divided by total deposits were regressed on TIME. The results are shown in Figures 4.12 and 4.13. Figure 4.12 shows a cyclical pattern but the fluctuations remain in a very narrow range. Figure 4.13, representative for all states, displays a clear trend. Mortgage investments rise from 11 percent to 18 percent.

4.6 Summary and Conclusions

In this chapter I have first applied the models developed in chapter 3 to an analysis of the demand for deposits at savings and loan associations and at commercial banks in six states.

The two most interesting findings are the wide variations in the interest sensitivity of depositors across states and the surprisingly large structural differences in the demand for commercial bank deposits.

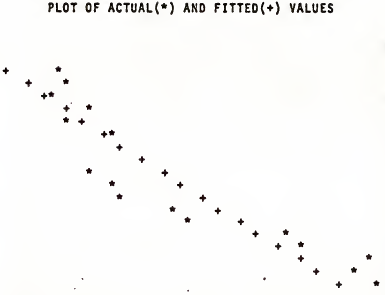
The second part of the empirical analysis is concerned with the portfolio behavior of the two financial intermediaries of interest. Apart from minor institutional differences, mortgage lending behavior of savings and loan associations differs only slightly

```
                                     PLOT OF ACTUAL(*) AND FITTED(+) VALUES                    PLOT OF RESIDUALS(*)

ID     ACTUAL       FITTED                                                        RESIDUAL
                                                                                                        0.0
6612   0.2218       0.2092                             +                   *       0.126E-01       .      .      .  *
6706   0.2089       0.2092                             +                          -0.259E-03       .      *      .
6712   0.2057       0.2092                        *    +                          -0.355E-02       .   *  .      .
6806   0.2125       0.2093                             +     *                     0.326E-02       .      .  *   .
6812   0.2032       0.2093                    *        +                          -0.609E-02       . *    .      .
6906   0.2132       0.2093                             +      *                    0.386E-02       .      .  *   .
6912   0.2194       0.2094                             +                *          0.100E-01       .      .      .*
7006   0.2181       0.2094                             +              *            0.866E-02       .      .      *
7012   0.1944       0.2094      *                      +                          -0.151E-01   *   .      .      .
7106   0.1963       0.2095         *                   +                          -0.132E-01    *  .      .      .
7112   0.1936       0.2095     *                       +                          -0.159E-01 *     .      .      .
7206   0.2007       0.2095                *              +                        -0.886E-02       *      .      .
7212   0.1995       0.2096              *                +                        -0.100E-01      *.      .      .
7306   0.2147       0.2096                               +      *                  0.504E-02       .      .   *  .
7312   0.2203       0.2097                               +               *        0.106E-01       .      .      .*
7406   0.2255       0.2097                               +                       * 0.158E-01       .      .      .    *
7412   0.2155       0.2097                               +        *               0.576E-02       .      .   *  .
7506   0.2071       0.2098                                                     *   +                        -0.267E-02       .    * .      .
```

Figure 4.12 - California Commercial Banks, Mortgage Holdings

```
ID      ACTUAL        FITTED                                  RESIDUAL
6612    0.1112        0.9819E-01                              0.130E-01
6706    0.1132        0.1028                                  0.105E-01
6712    0.1096        0.1073                                  0.225E-02
6306    0.1168        0.1119                                  0.494E-02
6812    0.1118        0.1165                                 -0.468E-02
6906    0.1231        0.1210                                  0.206E-02
6912    0.1243        0.1256                                 -0.127E-02
7006    0.1308        0.1302                                  0.622E-03
7012    0.1185        0.1347                                 -0.163E-01
7106    0.1230        0.1393                                 -0.163E-01
7112    0.1256        0.1439                                 -0.183E-01
7206    0.1380        0.1484                                 -0.104E-01
7212    0.1409        0.1530                                 -0.121E-01
7306    0.1633        0.1576                                  0.573E-02
7312    0.1669        0.1622                                  0.477E-02
7406    0.1840        0.1667                                  0.173E-01
7412    0.1803        0.1713                                  0.900E-02
7506    0.1851        0.1759                                  0.921E-02
```



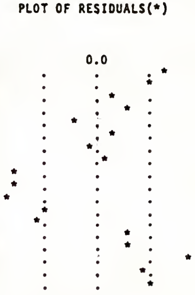


Figure 4.13 - Florida Commercial Banks, Mortgage Holdings

across states. Deposit flows and mortgage repayments were found to be the main determinants of their demand for mortgages, with relative interest rates having very little explanatory power. Although Federal Home Loan Bank advances could not be identified as directly affecting S&L mortgage lending, regional differences in S&L borrowing behavior were shown to exist.

Mainly because of the poorer quality of the data, the results for commercial bank portfolio behavior were statistically less significant but still highly suggestive. Regardless of their deposit composition, commercial banks attempt to maintain a relatively stable ratio of commercial and industrial loans to total deposits. The very significant regional differences in the size and speed of changes in the liability structure during the sample period were shown to lead to corresponding reductions in Government securities holdings and increases in bank holdings of the less liquid municipals and mortgage loans.

In summary, contrary to my a priori expectations but in line with the findings of national studies (Silber 1970), relative deposit flows and not interest rates have been found to be the main determinants of the portfolio behavior of both financial intermediaries. Since my findings indicate that there are significant structural differences in the demand for deposit flows across states, disaggregation of the financial sector of the economy by state should yield very useful information for disaggregated models of real activity.

4.7 Notes, Notation, Variable Definitions, and Data Sources

4.7.1 Notes

- * Sample period for S&L equations = 1969:1 to 1974:4 (28 quarterly observations).
- * Sample period for bank equations = 1966:12 to 1975:6 (18 semi-annual observations).
- * Dollar magnitudes are measured in billions of current dollars; interest rates are measured in percentage points; all flows are at quarterly rates.
- * The absolute values of t-statistics are shown in parentheses. $t_{(.10,24)} = 1.32$, $t_{(.05,24)} = 1.71$, $t_{(.01,24)} = 2.49$; $t_{(.10,15)} = 1.34$, $t_{(.05,15)} = 1.75$, $t_{(.01,15)} = 2.60$.
- * Where appropriate, the Durbin-Watson statistic (DW) is shown. For the equations with lagged dependent variables, I applied Durbin's Test I the small sample properties of which were examined by Maddala and Rao (1973).
- * ρ is the coefficient of serial correlation for those equations estimated with the iterative procedure of Cochrane and Orcutt. Otherwise, ordinary least squares was used.

4.7.2 Notation

Interest rates and related variables begin with R.
Balance sheet variables of savings and loan associations begin with S.
Balance sheet variables of commercial banks begin with B and are deflated by total deposits.
Flow variables end with F.
Lagged variables end with L.

4.7.3 Variable Definitions

CA	California
FL	Florida
IO	Idaho
NM	New Mexico
OH	Ohio
SC	South Carolina
B1	U.S. Treasury securities
B2	Obligations of States and political subdivisions
B3	Real estate loans
B4	Commercial and industrial loans
B6	Demand deposits
B67	Demand deposits/time deposits
B7	Time deposits
DUM	Seasonal dummy variable
MEAN	Mean of the dependent variable
RD2	RMUN - RM
RD3	RM - RMUNIC
RDIF	((3 * RM - RM(-2) - RM(-3) - RM(-4)) * S2(-1)
RF	Rate on FHLB advances
RFS1	RF * S1(-1)
RM	Effective conventional mortgage rate
RMS1	RM * S1(-1)
RMUN	Yield on AAA State and local government bonds
RTB	Three-month Treasury bill rate
RTBL	RTB(-1)
SA2L	Deposits(-1) / State personal income
S1	Deposits, adjusted for liquidity requirement
S1F	Δ deposits
S1L	Deposits(-1)
S2	Mortgage loans
S2L	S2(-1)
S3	FHLB advances to S&Ls of a particular state
S3SY	Total FHLB advances to all member associations
S4	Mortgage commitments outstanding
S4L	S4(-1)
S5	Mortgage repayments
TIME	Time trend: 1966:1 = 1, 1966:2 = 2, etc.

4.7.4 Data Sources

Bank data:	*Assets and Liabilities, Commercial and Mutual Savings Banks*, various issues.
Savings and loan data:	Federal Home Loan Bank Board District Banks 4, 5, 10, 11, 12.
Interest rates:	*Federal Reserve Bulletin*, various issues.
State personal income:	U.S. Department of Commerce, Bureau of Economic Analysis.

CHAPTER 5

DEPOSIT FLOWS, THE MORTGAGE MARKET, AND RESIDENTIAL CONSTRUCTION: AN APPLICATION WITHIN THE STATE OF FLORIDA

5.1 Introduction

Having demonstrated in the preceding chapter that there are significant regional differences in certain segments of the capital market, I estimate in this chapter a complete set of deposit flow and mortgage equations for the State of Florida. This is to determine whether regional financial variables hold the key to the explanation of short-run swings in regional real economic activity. The test is a very strenuous one since it is applied to private residential construction, the primary source of economic fluctuations in Florida during the sample period (Economic Report of the Governor, 1975).

Section 5.2 is devoted to a theoretical analysis of the short-run determinants of residential construction. Subsequent sections present the estimation results for the three sectors, the results of a dynamic simulation of the complete system of equations, and a forecast through 1978.

5.2 The Short-Run Determinants of Residential Construction

5.2.1 Introduction

For an analysis of the housing market, it is important to carefully distinguish between the short-run and the long-run, that is, between the determinants of the flow of new units and long-run stock equilibrium properties. The importance of this distinction is that some variables that account for most of the short-run variation in housing production apparently have no long-run effect. At the same time, some of the long-term determinants of housing demand vary very little in the short-run and cannot explain the wide cyclical swings in new private housing starts in the post-war period.

There is little disagreement in the literature about the factors that influence long-run demand for housing. The consensus is that the long-run stock demand for housing is primarily a function of income -- with some debate about the appropriate definition of income -- of relative prices (including housing operation costs), and of demographic factors (Fromm 1973, Gramley 1972). Monetary policy and Federal Home Loan Bank Board policy actions have been shown to have no discernible impact on the basic demand factors (Edwards 1975).

Models of the cyclical fluctuations in housing, in contrast, come to the conclusion that the swings in housing production reflect principally the response of residential construction to changes in general credit conditions (Kalchbrenner 1972). Since this study is only concerned with an analysis and forecasting of short-run behavior, I will focus in the following on the determinants of short-run regional residential construction.

5.2.2 Development of a Model of Housing Starts

Recognizing that the housing market is characterized by a high degree of market segmentation, that is, little substitution between the different types of housing, models of the housing market typically disaggregate by type of unit (Brady 1973). Separate models have to be specified for single-family units, mobile homes, multi-family units, and government subsidized housing.

Depending on the objective of the study, researchers have either entirely concentrated on explaining short-run behavior, or they have examined flows in a long-run equilibrium framework. Several attempts have been made to explicitely specify and estimate separate demand and supply relationships but the statistical properties of the demand equation are in each case less than satisfactory (Brady 1973). Fair (1973), Fair and Jaffee (1972a), and Swan (1972a) argue that no reliable estimates of the parameters can be obtained because the housing market is often in disequilibrium. Their disequilibrium approach does not yield very convincing results, however, as discussed earlier. In addition, the crucial relationship that specifies the disequilibrium aspect of the housing market is based on the assumption that the actual number of housing starts is equal to the minimum of either the demand or the supply schedule. This implies among other things that home builders will never supply more houses than are actually demanded at any given point in time. Bearing in mind the recent events in the Florida real estate market, I do not think that one should place too much confidence in the coefficient estimates of such a model.

Since I have specified structural relationships for both the market for savings deposits and the mortgage market - which enhances the model's usefulness for policy analysis - and since forecasting is the primary purpose in the housing sector, I will specify a reduced form equation for single-family housing starts. The specifications of housing start equations for the remaining types of housing units would be very similar in spirit. Because of data limitations, these equations cannot be estimated at the present time, however. Currently, there are no quarterly data available for out-of-state mortgage lenders which play an important role in multi-family financing. Also, the housing start series for multi-families is plagued by serious measurement errors. Even worse is the situation with respect to data on mobile home shipments.

The institutional framework in the U.S. single-family housing market is such that home builders construct the bulk of single-family homes for the sales market. In 1975, for example, 61 percent of private single-family units in the U.S. were developer-built (Savings and Loan Fact Book 1976). Therefore, an analysis of builder behavior will be the starting point for the specification of the housing starts equation. In fact, Huang (1973) has shown that the fluctuations in single-family starts are largely attributable to this speculative component of the starts.

In general, residential home builders can be expected to base their decisions on the following factors

$$(5.1) \quad HST = HST(P-C, VAC, CRED)$$

where: HST = single-family housing starts;

P-C = difference between the price and the cost of a house;

VAC = vacancy rate for single-families;

CRED = credit market conditions.

That is, builders are assumed to increase production when their profit margin goes up, when the vacancy rate declines, and when credit market conditions improve. Credit market conditions are expressed by the cost of credit, the mortgage rate, and credit availability. Measures of credit availability are the effective supply of mortgage credit and new commitments. These variables are exogenous to the housing sector but endogenous to the Florida Model. Therefore, they incorporate all spatial effects in the transmission of monetary policy and/or FHLBB actions.

Builders' production decisions have been shown to be heavily influenced by the vacancy rate (Burnham 1973). The importance of the vacancy rate derives from the fact that it can be interpreted as a measure of disequilibrium in the housing market. That is, a vacancy rate above some "normal" level indicates that there is an excess supply of houses and a relatively low rate indicates excess demand. A high vacancy rate or the expectation of a rising vacancy rate will cause builders to cut back on production.

The vacancy rate gains particular significance in this model because of its regional nature. Housing markets are local markets since for all practical purposes housing services cannot be transferred across regions. Indeed, one can observe wide regional variations in the vacancy rate across the country which shows that national aggregates are of very limited value as indicators of housing market conditions. This points to another problem area that requires careful attention. Aggregation not only obscures possible severe regional imbalances in demand and supply of houses but it also makes it impossible to detect the determinants of these disequilibria.

Two modifications will have to be made before equation (5.1) can be estimated. First, since the dependent variable is number of houses started, the explanatory variable must be expressed in real terms also. For this purpose, a national deflator will be used. Second, for the coefficients to be meaningful and comparable, an appropriate scaling variable such as number of households will have to be used.

The development of the housing start equation so far has stressed the supply aspects mainly induced by national impulses. In order to allow for demand factors, I will specify the vacancy rate as

$$(5.2) \quad VAC = VAC\,(\Delta HH, \Delta FA, \Delta CC)$$

where: HH = number of households;

FA = real financial assets of the household sector;

CC = measure of consumer confidence.

A short-run increase in the number of households is expected to lead to a decrease in the vacancy rate. Increases in financial assets and in consumer confidence should have the same effect.

As discussed earlier, short-run demand equations in national models generally do not perform very well. One reason for this appears to be that the demographic factors at the national level display very little variation. At the regional level, however, I expect that demographic variables should have much higher explanatory power. Migration, insignificant at the national level, should account for a large proportion of a region's household formations, one of the main determinants of housing demand.

5.3 The Estimated Model

The complete estimated model consists of three blocks: a savings and loan associations block, a commercial banks block, and an equation for private residential construction. The estimation results are shown in section 5.6.

The structure of the equations in the S&L block is discussed in detail in chapter 4. The only difference between the results presented there and the results shown in section 5.6 is that the latter were obtained using the two stage least-squares estimation technique where theoretically indicated. With the exception of the mortgage acquisitions equation where the mortgage repayments variable became statistically insignificant and was therefore omitted in the final estimation, the results are very similar to the OLS estimates.

The commercial banks block consists of three equations (demand deposits, time deposits, mortgage holdings), the specification of all of whom corresponds very closely to the models developed in chapter 3.

The deposit equations and the demand equation for mortgage loans were estimated in the following form:

$$(5.3) \quad \Delta FDD = b_1 * FDD(-1) + b_2 * (RTB(-1) * YPF) + b_3 * (RTD * YPF) + b_4 * (PC * YPF) + b_5 * YPF + b_0$$

$$(5.4) \quad \Delta FDT = b_1 * FDT(-1) + b_2 * (RTB * YPF) + b_3 * (RTD * YPF) + b_4 * (RSL * YPF) + b_5 * YPF + b_0$$

$$(5.5) \quad FMTGB = b_1 * FMTGB(-1) + b_2 * (FDD(-1) + FDT(-1)) + b_3 * \Delta FDT + b_0$$

where: FDD = Demand deposits at Florida commercial banks;

FDT = Time deposits at Florida commercial banks;

FMTGB = Mortgage holdings of Florida commercial banks;

RTB = Three-month Treasury bill rate;

RTD = Rate on commercial bank time deposits;

RSL = Rate on savings and loan deposits; and

YPF = Florida personal income.

All of the estimated coefficients are of the expected sign and highly significant. The equations fit the data rather well, with a surprisingly good fit for the mortgage equation. The results for this equation, which was estimated with quarterly data, confirm the finding of chapter 4 that relative deposit flows are the main determinants of commercial bank asset demand.

It is interesting to compare the interest rate elasticities of the two bank deposit equations with the savings and loan deposit equation. Evaluated at the means of the variables, the short-run elasticity with respect to the open market yield in the demand deposit equation is -.04, in the time deposit equation -.03, and in the savings and loan deposit equation -.08. This confirms the earlier finding that S&Ls are much more exposed to changes in the yield of short-term market instruments than commercial banks. As explained in chapter 4, multicollinearity made it impossible to obtain a reliable coefficient estimate for the time deposit interest rate variable in the S&L deposit equation. Fortunately, the competing yield variable (S&L deposit rate) is statistically significant in the time deposit equation. The estimated coefficient of -.045 for the S&L deposit rate implies a very high short-run elasticity of -.89 with respect to this rate. Although the effective yields on commercial bank time deposits and S&L deposits tend to move together because of Regulation Q, the elasticity clearly indicates a high degree of substitution between time deposits at commercial banks and S&L deposits in Florida.

The housing starts equation was estimated in the following form:

$$(5.6)\quad CSS = b_1 * \Delta S4 + b_2 * \Sigma a_t \Delta S2_t + b_3 * \Delta FMTGB + b_0$$

where: CSS = value of new single-family construction put in place;

S4 = savings and loan mortgage commitments outstanding;

S2 = savings and loan mortgage holdings; and

FMTGB = commercial bank mortgage holdings.

Equation (5.6) reflects the thrust of the theoretical arguments developed in section 5.2. Data limitations necessitated several empirical modifications, however.

First, the dependent variable is the value of new construction put in place in current dollars and not housing starts. No housing start data are collected for

Florida and the deficiencies of the closest proxy, housing permits, particularly during the critical cyclical turning points, are notorious (Brady 1973).

Second, the vacancy rate variable is not included in the final version because of its statistical insignificance. Several factors may be responsible for this rather disappointing performance of the vacancy rate variable. The quarterly vacancy rate series was constructed from annual and semi-annual postal vacancy rate surveys of the major Florida SMSAs. Too much information may have been lost in the process of interpolating the data. Alternatively, the lack of explanatory power could be interpreted as a confirmation of the finding of other housing studies (Brady 1973, Gramley 1972), namely, that supply factors are more important in explaining the quarterly variation in residential construction than are demand variables.

Finally, the relative price variables and the demographic variables dropped out. It appears that the main problem is also one of data quality. There exist no construction cost indexes for Florida and quarterly migration data are straight interpolations from annual data.

The remaining independent variables are therefore all financial variables. Each one of them is highly significant and together they explain more than 96 percent of the variation in single-family construction. The performance of the equation will be analyzed in greater detail in the next section but it may be noted here that the goodness of fit of this investment equation is quite remarkable by all standards. Alternative specifications were tried, including such national variables as interest rate spreads, interest rate ratios, and mortgage holdings of the major financial intermediaries, but the ratio of the standard error divided by the mean of the dependent variable was in every instance at least twice as large.

Despite the questionable quality of the multifamily construction data, I tried a number of different equation specifications for this variable. Given that Florida savings and loan associations and commercial banks hold only an insignificant amount of multi-family mortgages (approximately 2 percent of total mortgage loans purchased in 1975), it came as no surprise that the inclusion of Florida financial variables lead to poor regression results, clearly indicating that the market for large multi-family mortgages is not a local one. Better results for the sample period were achieved with such national variables as mortgage holdings of U.S. commercial banks, and mortgage holdings and commitments of life insurance companies. Forecasts based on these regression results produced forecast errors of about 400 percent, however. Since the problem is beyond the scope of this study, it was not further investigated.

5.4 Historical Simulation and Forecast

In contrast to single equation regressions where test statistics such as the coefficient of multiple determination, t values, and other tests provide relatively unambiguous measures of the goodness of fit of an equation, the evaluation and validation of simultaneous equation models is more complex. The reason for this is that good statistical fits of each individual equation are not a sufficient condition for a multiple equation model to produce a close reproduction of the historical time series. A fortiori, even less can be said about the predictive performance of such a model.

The most widely used technique for testing a simultaneous equations model and obtaining the crucial information about its dynamic structure is the dynamic simulation of the complete system (Cooper 1974). That is, the model (including its identities) is solved for a given time period to yield solutions for each of the endogenous variables conditional on values of the exogenous variables. The dynamic simulation requires only the initial values for the endogenous variables. During the simulation period, the solution values are used instead of actual values for the endogenous variables.

A thorough evaluation of a forecasting model calls for two types of simulations. First, the model must be simulated during a period for which historical data for all variables are available. This is called an ex post, or historical simulation (Cooper and Nelson 1975). Several quantitative measures exist to assess how closely individual variables track their corresponding data series. Two frequently used error measures are the RMS (root-mean-square) simulation error and the mean absolute percent error (XMAPE). They are defined as follows:

$$\text{RMS} = \text{SQRT}\left(\frac{1}{T}\sum_{t=1}^{T}(P_t - A_t)^2\right)$$

$$\text{XMAPE} = \frac{1}{T}\sum_{t=1}^{T}\frac{\text{abs}(P_t - A_t)}{A_t}$$

where: P = predicted (solved) value;
A = actual value;
T = number of periods in the simulation;
abs = absolute value; and
SQRT = square root.

Since XMAPE is standardized, it allows comparison across variables. The RMS error penalizes large individual errors more heavily but its magnitude can be evaluated only by comparing it with the mean value of the particular variable. An additional performance criterion is the model's ability to reproduce the actual turning points.

The second mode of simulation is forecasting, that is, simulating the model forward in time beyond the sample period. If actual data for the exogenous variables are available and used, the forecast is called an *ex post* forecast. A forecast based on predicted values for the exogenous variables, on the other hand, is called an *ex ante* forecast. It is quite evident that *ex post* forecasts are particularly important for an assessment of a model's forecasting performance.

Ex post and *ex ante* dynamic simulations were performed for the complete set of deposit flow, mortgage, and construction equations. A discussion of the Gaus -

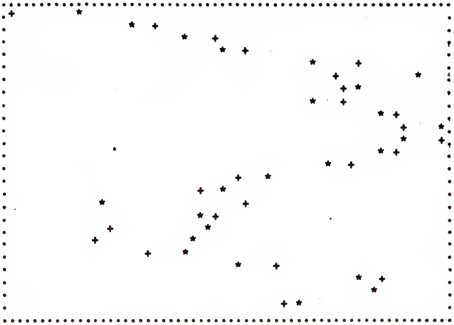
Seidel simulation method that was used to solve this set of simultaneous equations can be found in Cooper (1974).

The results of the historical simulation are shown in Figures 5.1 to 5.13. Figures 5.1 and 5.2 demonstrate again the wide swings in S&L deposit flows between the first quarter of 1970 and the last quarter of 1975. The simulation tracks the actual data rather well although it does not fully reproduce the severity of the 1974 downturn. The "predicted" stock of deposits never deviates significantly from the actual level. This can be seen quite clearly in Figure 5.2 but it is also expressed in an XMAPE of a mere .6 percent. The simulation of the remaining two sources of loanable funds for S&Ls, repayments and FHLB advances, yielded also quite satisfactory results. Most reassuring, however, are the results for mortgage acquisitions and mortgage holdings. Every single change in direction in mortgage activity is accurately reproduced and after 24 quarters of simulation the mortgage stock is overestimated by only $ 140 million, an error of .7 percent (Figures 5.5 and 5.6).

Figures 5.8 to 5.11 reveal an equally reassuring picture for the bank deposit equations. The only equation that displays a significantly different performance in the simulation than in the estimation is the commercial

```
                              FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIDUALS                                  RANGE      0.00  TO     0.03
 @S1/Y+    @S1/Y*

 0.002      0.005     -0.004   701
 0.010      0.008      0.002   702
 0.013      0.012      0.002   703
 0.015      0.014      0.001   704
 0.022      0.019      0.003   711
 0.020      0.025     -0.005   712
 0.021      0.022     -0.001   713
 0.021      0.019      0.002   714
 0.024      0.023      0.001   721
 0.024      0.026     -0.002   722
 0.026      0.024      0.002   723
 0.024      0.023      0.001   724
 0.021      0.020      0.001   731
 0.015      0.017     -0.002   732
 0.012      0.014     -0.001   733
 0.015      0.007      0.008   734
 0.013      0.012      0.001   741
 0.007      0.013     -0.005   742
 0.006      0.012     -0.005   743
 0.009      0.011     -0.002   744
 0.017      0.015      0.002   751
 0.023      0.022      0.001   752
 0.023      0.023     -0.000   753
 0.017      0.018     -0.001   754
```



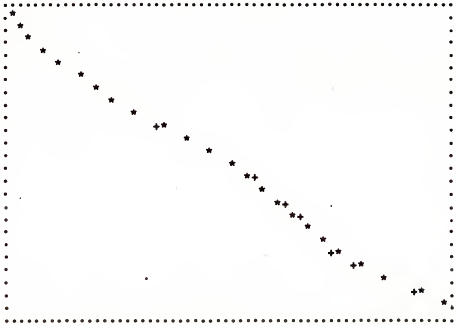
```
MSE=   0.000     RMS=   0.003    RHO=   0.108
MEAN ERR=     -0.0000    MEAN=      0.0167    XMAPE=       0.2697
```

Figure 5.1 - Historical Simulation: Savings and Loan Associations, Deposit Flows

```
                                  FINANCIAL SIMULATIONS    10/19/76

ACTUAL    SOLUTION  RESIDUALS                         RANGE     7.14  TO    21.53
 S1   +     S1   *

  7.135     7.229    -0.094   701
  7.390     7.443    -0.054   702
  7.738     7.744    -0.005   703
  8.137     8.105     0.032   704
  8.727     8.617     0.110   711
  9.294     9.319    -0.025   712
  9.888     9.940    -0.052   713
 10.503    10.508    -0.005   714
 11.246    11.218     0.028   721
 12.030    12.062    -0.032   722
 12.912    12.864     0.048   723
 13.760    13.682     0.078   724
 14.538    14.409     0.129   731
 15.100    15.042     0.058   732
 15.593    15.590     0.004   733
 16.208    15.876     0.332   734
 16.774    16.391     0.383   741
 17.094    16.946     0.148   742
 17.384    17.475    -0.091   743
 17.805    17.988    -0.183   744
 18.552    18.651    -0.100   751
 19.591    19.628    -0.036   752
 20.637    20.675    -0.038   753
 21.451    21.531    -0.079   754
```



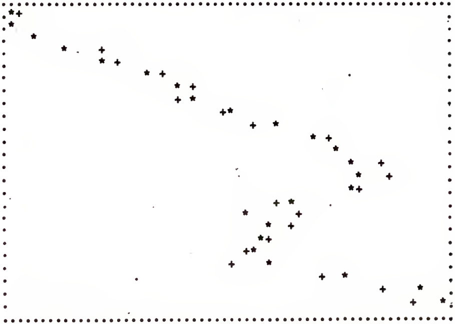
```
      MSE=   0.017     RMS=   0.129     RHO=   0.594
      MEAN ERR=        0.0232    MEAN=      13.7286     XMAPE=       0.0064
```

Figure 5.2 - Historical Simulation: Savings and Loan Associations, Deposits

```
                              FINANCIAL SIMULATIONS    10/19/76

ACTUAL   SOLUTION  RESIDUALS                          RANGE     0.20  TO     0.49
 S5   +    S5    *

 0.203     0.197      0.006   701
 0.197     0.197     -0.000   702
 0.212     0.210      0.002   703
 0.258     0.231      0.027   704
 0.267     0.259      0.007   711
 0.300     0.288      0.012   712
 0.320     0.312      0.007   713
 0.311     0.322     -0.011   714
 0.343     0.343     -0.000   721
 0.360     0.379     -0.019   722
 0.410     0.404      0.006   723
 0.418     0.419     -0.001   724
 0.448     0.428      0.019   731
 0.455     0.432      0.023   732
 0.431     0.426      0.005   733
 0.377     0.385     -0.008   734
 0.390     0.358      0.032   741
 0.384     0.370      0.014   742
 0.369     0.366      0.003   743
 0.354     0.361     -0.007   744
 0.348     0.374     -0.025   751
 0.409     0.423     -0.014   752
 0.449     0.475     -0.027   753
 0.469     0.489     -0.020   754
```

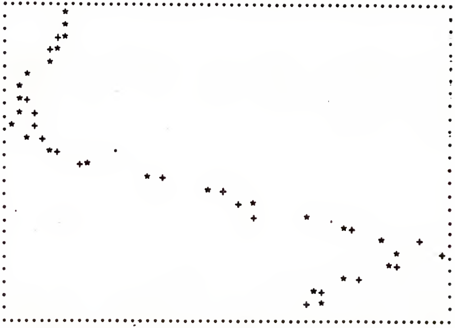


```
MSE=   0.000      RMS=   0.015    RHO=   0.470
MEAN ERR=      0.0012    MEAN=      0.3533    XMAPE=        0.0341
```

Figure 5.3 - Historical Simulation: Savings and Loan Associations, Mortgage Repayments

```
                                   FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIDUALS                                     RANGE     0.07  TO     1.29
 S3   +    S3    *

 0.208     0.208    -0.001   701
 0.209     0.224    -0.015   702
 0.190     0.211    -0.022   703
 0.175     0.192    -0.018   704
 0.177     0.174     0.003   711
 0.104     0.105    -0.001   712
 0.099     0.087     0.011   713
 0.117     0.099     0.018   714
 0.122     0.079     0.043   721
 0.137     0.068     0.069   722
 0.144     0.102     0.042   723
 0.198     0.176     0.022   724
 0.251     0.293    -0.042   731
 0.501     0.455     0.046   732
 0.676     0.625     0.050   733
 0.704     0.765    -0.061   734
 0.757     0.909    -0.152   741
 1.043     1.010     0.034   742
 1.232     1.123     0.109   743
 1.294     1.172     0.122   744
 1.173     1.144     0.029   751
 1.062     1.010     0.052   752
 0.946     0.933     0.013   753
 0.912     0.952    -0.040   754
```

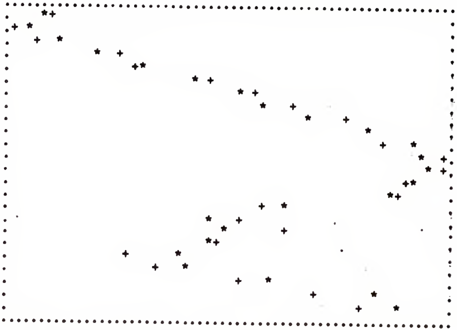


```
                    MSE=   0.003     RMS=   0.057    RHO=   0.379
                    MEAN ERR=       0.0130    MEAN=       0.5179    XMAPE=      0.1171
```

Figure 5.4 - Historical Simulation: Savings and Loan Associations, Federal Home Loan Bank Advances

```
                              FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                   RANGE     0.30  TO    1.34
 S2A  +    S2A  *

 0.399      0.369     0.029   701
 0.304      0.347    -0.043   702
 0.366      0.405    -0.038   703
 0.553      0.504     0.049   704
 0.599      0.618    -0.019   711
 0.775      0.736     0.039   712
 0.884      0.852     0.032   713
 0.968      0.911     0.057   714
 1.094      1.009     0.085   721
 1.161      1.163    -0.002   722
 1.187      1.257    -0.070   723
 1.335      1.291     0.044   724
 1.338      1.301     0.037   731
 1.254      1.268    -0.015   732
 1.225      1.204     0.021   733
 0.897      0.957    -0.060   734
 0.842      0.776     0.066   741
 0.961      0.814     0.148   742
 0.798      0.768     0.030   743
 0.581      0.706    -0.125   744
 0.641      0.717    -0.076   751
 0.853      0.922    -0.069   752
 1.026      1.168    -0.143   753
 1.135      1.222    -0.088   754
```



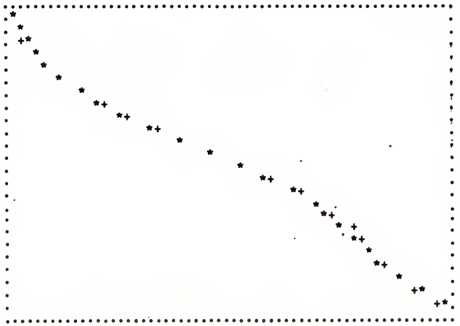
```
MSE=   0.005     RMS=   0.069     RHO=   0.495
MEAN ERR=      -0.0046   MEAN=      0.8824    XMAPE=      0.0741
```

Figure 5.5 - Historical Simulation: Savings and Loan Associations, Mortgage Acquisitions

```
                                            FINANCIAL SIMULATIONS   10/19/76

 ACTUAL    SOLUTION  RESIDUALS                               RANGE     7.20  TO    19.87
  S2   +     S2   *

  7.228      7.204      0.024   701
  7.335      7.354     -0.019   702
  7.490      7.548     -0.058   703
  7.786      7.821     -0.036   704
  8.118      8.180     -0.062   711
  8.593      8.628     -0.035   712
  9.157      9.168     -0.011   713
  9.815      9.757      0.058   714
 10.565     10.423      0.143   721
 11.367     11.208      0.159   722
 12.144     12.061      0.083   723
 13.061     12.933      0.128   724
 13.951     13.806      0.145   731
 14.750     14.643      0.108   732
 15.545     15.421      0.124   733
 16.065     15.993      0.072   734
 16.516     16.410      0.106   741
 17.093     16.854      0.240   742
 17.523     17.255      0.267   743
 17.750     17.600      0.149   744
 18.043     17.944      0.099   751
 18.487     18.443      0.044   752
 19.064     19.136     -0.072   753
 19.730     19.869     -0.139   754
```



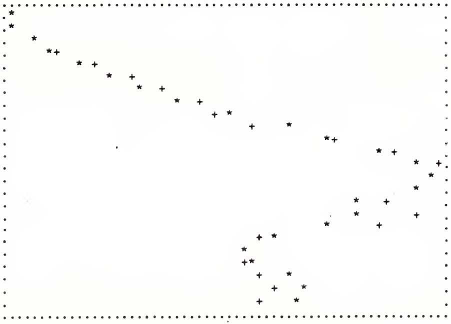
```
         MSE=    0.014     RMS=    0.118     RHO=    0.805
         MEAN ERR=      0.0632     MEAN=      13.2156     XMAPE=        0.0073
```

Figure 5.6 - Historical Simulation: Savings and Loan Associations, Mortgage Holdings

```
                                   FINANCIAL SIMULATIONS    10/19/76

ACTUAL    SOLUTION  RESIDUALS                                RANGE     0.23  TO     1.53
 S4   +     S4   *


 0.237      0.234      0.002   701
 0.245      0.241      0.004   702
 0.305      0.300      0.005   703
 0.367      0.344      0.023   704
 0.484      0.433      0.051   711
 0.593      0.532      0.060   712
 0.681      0.625      0.056   713
 0.794      0.736      0.058   714
 0.845      0.898     -0.053   721
 0.960      1.072     -0.112   722
 1.202      1.196      0.006   723
 1.401      1.340      0.061   724
 1.532      1.456      0.077   731
 1.498      1.507     -0.008   732
 1.470      1.455      0.014   733
 1.369      1.271      0.098   734
 1.460      1.275      0.185   741
 1.351      1.195      0.157   742
 0.994      1.024     -0.030   743
 0.936      0.943     -0.007   744
 0.942      0.959     -0.017   751
 0.977      1.071     -0.094   752
 1.033      1.131     -0.098   753
 0.985      1.110     -0.125   754
```

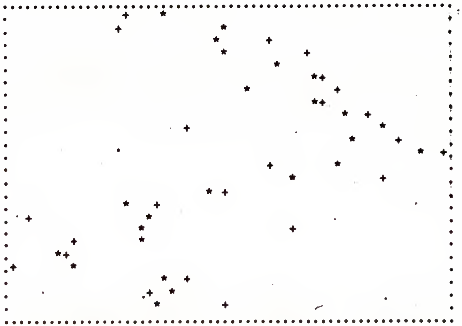


```
MSE=   0.006     RMS=   0.077    RHO=   0.624
MEAN ERR=      0.0131    MEAN=      0.9442    XMAPE=      0.0602
```

Figure 5.7 - Historical Simulation: Savings and Loan Associations, Mortgage Commitments

```
                              FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIDUALS                                 RANGE    -0.21  TO     0.48
 @FDD +     @FDD *

-0.028      0.037    -0.065   701
-0.035      0.130    -0.165   702
 0.201      0.124     0.077   703
 0.268      0.129     0.139   704
 0.210      0.213    -0.003   711
 0.287      0.275     0.012   712
 0.316      0.172     0.144   713
 0.291      0.278     0.013   714
 0.356      0.322     0.034   721
 0.074      0.377    -0.303   722
 0.403      0.335     0.068   723
 0.479      0.442     0.037   724
 0.199      0.313    -0.114   731
 0.377      0.240     0.137   732
 0.132      0.112     0.020   733
 0.027     -0.022     0.048   734
-0.179      0.014    -0.192   741
 0.238     -0.007     0.245   742
-0.111      0.003    -0.114   743
-0.125     -0.134     0.009   744
-0.206     -0.105    -0.101   751
 0.073      0.029     0.044   752
 0.011      0.047    -0.036   753
 0.126      0.019     0.107   754
```

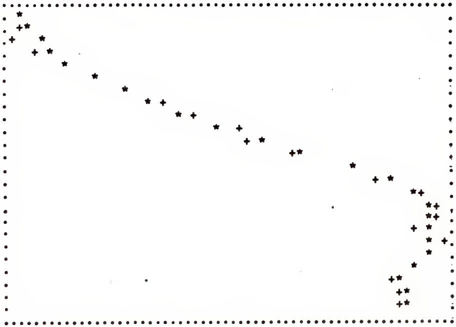


```
MSE=    0.014     RMS=    0.120     RHO=   -0.368
MEAN ERR=       0.0017     MEAN=       0.1410     XMAPE=       0.2071
```

Figure 5.8 - Historical Simulation: Commercial Banks, Demand Deposit Flows

```
                                   FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                                    RANGE     6.17  TO     9.85
 FDDL +    FDDL *

 6.230     6.230     0.0      701
 6.202     6.267    -0.065    702
 6.167     6.397    -0.230    703
 6.368     6.521    -0.153    704
 6.636     6.650    -0.014    711
 6.846     6.863    -0.017    712
 7.133     7.138    -0.005    713
 7.449     7.310     0.139    714
 7.741     7.589     0.152    721
 8.097     7.910     0.186    722
 8.171     8.287    -0.117    723
 8.573     8.622    -0.049    724
 9.052     9.064    -0.012    731
 9.251     9.377    -0.126    732
 9.628     9.617     0.011    733
 9.760     9.729     0.031    734
 9.787     9.707     0.080    741
 9.609     9.721    -0.113    742
 9.847     9.714     0.133    743
 9.736     9.718     0.018    744
 9.611     9.584     0.027    751
 9.405     9.479    -0.074    752
 9.478     9.508    -0.030    753
 9.488     9.555    -0.067    754
```

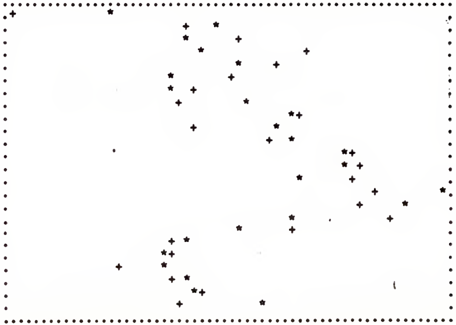


```
MSE=   0.010     RMS=   0.100     RHO=   0.287
MEAN ERR=     -0.0122     MEAN=       8.3444     XMAPE=        0.0097
```

Figure 5.9 - Historical Simulation: Commercial Banks, Demand Deposits

```
                                  FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                             RANGE    -0.06  TO    0.73
 @FDT +    @FDT *

-0.060     0.120    -0.180   701
 0.264     0.314    -0.049   702
 0.357     0.254     0.103   703
 0.476     0.287     0.189   704
 0.429     0.356     0.073   711
 0.336     0.227     0.109   712
 0.275     0.239     0.037   713
 0.251     0.375    -0.124   714
 0.468     0.453     0.015   721
 0.277     0.424    -0.147   722
 0.406     0.448    -0.042   723
 0.565     0.557     0.009   724
 0.575     0.547     0.029   731
 0.559     0.468     0.091   732
 0.612     0.732    -0.120   733
 0.577     0.664    -0.087   734
 0.634     0.454     0.180   741
 0.453     0.363     0.089   742
 0.231     0.256    -0.026   743
 0.227     0.215     0.012   744
 0.131     0.217    -0.086   751
 0.230     0.259    -0.029   752
 0.288     0.268     0.021   753
 0.244     0.401    -0.157   754
```

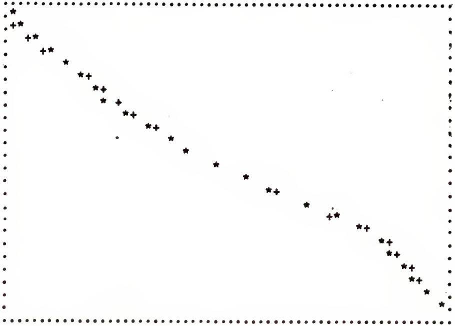


```
MSE=   0.010     RMS=   0.101     RHO=   0.217
MEAN ERR=     -0.0037     MEAN=      0.3669    XMAPE=       0.0991
```

Figure 5.10 - Historical Simulation: Commercial Banks, Time Deposit Flows

```
                                   FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIOUALS
 FDTL +     FOTL *                                         RANGE     5.41  TO    14.04

 5.473     5.473      0.0     701
 5.413     5.593     -0.180   702
 5.678     5.907     -0.229   703
 6.035     6.161     -0.126   704
 6.510     6.447      0.063   711
 6.939     6.803      0.136   712
 7.275     7.030      0.245   713
 7.551     7.269      0.282   714
 7.802     7.643      0.158   721
 8.269     8.096      0.173   722
 8.546     8.520      0.026   723
 8.952     8.968     -0.016   724
 9.518     9.525     -0.007   731
10.093    10.071      0.022   732
10.652    10.539      0.112   733
11.264    11.271     -0.007   734
11.841    11.935     -0.095   741
12.475    12.390      0.085   742
12.928    12.753      0.175   743
13.159    13.010      0.149   744
13.386    13.224      0.162   751
13.517    13.442      0.075   752
13.747    13.701      0.046   753
14.036    13.969      0.067   754
```



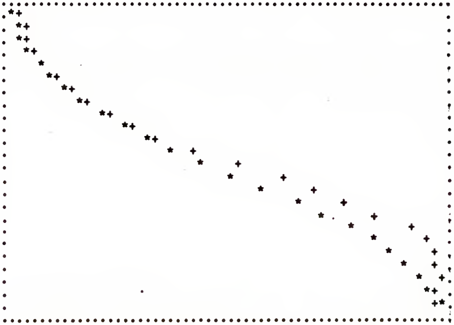
```
MSE=   0.018     RMS=   0.135     RHO=   0.707
MEAN ERR=     0.0549    MEAN=     9.6275    XMAPE=      0.0133
```

Figure 5.11 - Historical Simulation: Commercial Banks, Time Deposits
]

```
                                   FINANCIAL SIMULATIONS    10/19/76

ACTUAL   SOLUTION  RESIDUALS                              RANGE     1.51  TO     4.44
 FMTGB+    FMTGB*

 1.578     1.513     0.065    701
 1.611     1.544     0.067    702
 1.616     1.571     0.045    703
 1.657     1.629     0.029    704
 1.739     1.706     0.034    711
 1.840     1.779     0.061    712
 1.916     1.876     0.041    713
 2.019     1.997     0.022    714
 2.186     2.122     0.064    721
 2.356     2.258     0.098    722
 2.504     2.416     0.088    723
 2.726     2.600     0.126    724
 3.030     2.790     0.241    731
 3.351     2.992     0.359    732
 3.563     3.229     0.334    733
 3.788     3.442     0.346    734
 3.985     3.635     0.350    741
 4.231     3.811     0.420    742
 4.342     3.959     0.383    743
 4.410     4.086     0.324    744
 4.410     4.196     0.214    751
 4.438     4.282     0.156    752
 4.393     4.353     0.040    753
 4.408     4.438    -0.030    754
```



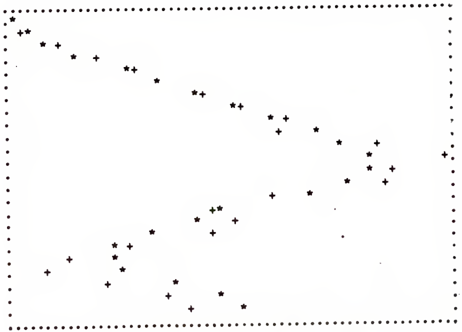
```
MSE=   0.046     RMS=   0.214     RHO=   0.918
MEAN ERR=      0.1615    MEAN=        3.0041    XMAPE=        0.0494
```

Figure 5.12 - Historical Simulation: Commercial Banks, Mortgage Holdings

```
                                   FINANCIAL SIMULATIONS   10/19/76

ACTUAL    SOLUTION  RESIDUALS                                   RANGE     0.18  TO     0.49
 CSS  +     CSS  *

 0.180     0.178      0.003   701
 0.184     0.188     -0.004   702
 0.211     0.202      0.009   703
 0.238     0.224      0.015   704
 0.265     0.259      0.005   711
 0.284     0.284     -0.000   712
 0.318     0.312      0.006   713
 0.345     0.339      0.005   714
 0.380     0.368      0.012   721
 0.373     0.400     -0.027   722
 0.443     0.419      0.024   723
 0.495     0.439      0.055   724
 0.456     0.437      0.018   731
 0.451     0.422      0.029   732
 0.367     0.396     -0.029   733
 0.320     0.325     -0.005   734
 0.341     0.311      0.030   741
 0.322     0.278      0.044   742
 0.260     0.249      0.010   743
 0.215     0.249     -0.034   744
 0.200     0.258     -0.058   751
 0.247     0.296     -0.050   752
 0.289     0.330     -0.041   753
 0.304     0.344     -0.040   754
```



```
MSE=    0.001      RMS=    0.029     RHO=    0.606
MEAN ERR=     -0.0009     MEAN=       0.3119     XMAPE=        0.0772
```

Figure 5.13 - Historical Simulation: Private Residential Construction (Single-Family)

bank mortgage equation (Figure 5.12). It tracks the actual data series rather closely at the beginning of the simulation period but shows clear signs of drift after about eleven quarters. While the equation displays serious deficiencies for long-term forecasting, it should still be quite useful for short-term prediction.

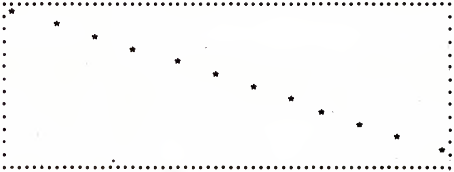
The severety of the test for the private residential construction equation is clearly expressed in Figure 5.13. During the simulation period, quarterly investment flows rose from $ 180 million to $ 500 million, dropped back to $ 200 million and are on the rise again with $ 300 million in 75:4. Based solely on financial variables, the simulation reproduces these cyclical swings very well although the cycles are dampened somewhat. While it is obviously not possible to make a strict comparison between models that are simulated over different intervals and differ in other important respects as well, the order of magnitude of the summary error measures should still provide some information about the relative performance of the models. Gramlich and Hulett (1972) and Fishkind (1975) report the RMS error of their solution and the mean value of the dependent variable for a national and a regional model, respectively. The quarterly model of Gramlich and Hulett is simulated between 57:1 and 69:4 and RMS divided by the mean of their single-family housing starts equation yields 9.7 percent. The corresponding figure for Fishkind's residential housing equation which is simulated between 1960 and 1973 with annual data, is 35 percent. It should be noted, however, that this latter figure compares quite favorably with other regional models (Fishkind 1975). Since the calculation of the same standardized error statistic for the Florida private residential construction equation (Figure 5.13) yields 9.3 percent, it appears that the correct specification of disaggregated financial variables improves the performance of regional models very significantly.

This claim is further substantiated in the second simulation, the simulation beyond the sample period which is presented in Figures 5.14 to 5.19. This forecast is based on the September 24, 1976 Data Resources, Inc. control solution forecast for the U.S. economy. Since the forecast starts with the first quarter of 1976, actual data for most of the variables were available for one or two quarters when the simulation was run. At least for 76:1 the forecast may thus be treated as an ex post forecast and ex post forecast errors can be calculated. Because testing was the major purpose of this simulation, no adjustments were made in the model to provide more realistic forecasts.

```
                              FINANCIAL SIMULATIONS    10/19/76

ACTUAL   SOLUTION  RESIDUALS                               RANGE    22.49  TO    34.45
 S1   +    S1   *

22.487    22.487     0.0     761
23.673    23.673     0.0     762
24.777    24.777     0.0     763
25.891    25.891     0.0     764
27.029    27.029     0.0     771
28.108    28.108     0.0     772
29.159    29.159     0.0     773
30.167    30.167     0.0     774
31.137    31.137     0.0     781
32.115    32.115     0.0     782
33.228    33.228     0.0     783
34.446    34.446     0.0     784
```

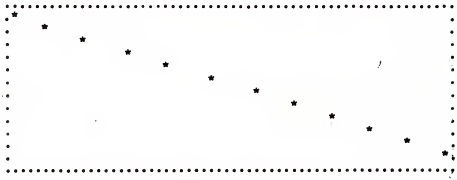


```
MSE=   0.0       RMS=   0.0       RHO=  0.0
MEAN ERR=     0.0       MEAN=     28.5179    XMAPE=      0.0
```

Figure 5.14 - Forecast: Savings and Loan Associations, Deposits

```
                              FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                      RANGE     20.45  TO    32.30
 S2   +    S2   *

20.446    20.446      0.0      761
21.355    21.355      0.0      762
22.393    22.393      0.0      763
23.488    23.488      0.0      764
24.655    24.655      0.0      771
25.846    25.846      0.0      772
27.018    27.018      0.0      773
28.148    28.148      0.0      774
29.211    29.211      0.0      781
30.210    30.210      0.0      782
31.217    31.217      0.0      783
32.297    32.297      0.0      784
```

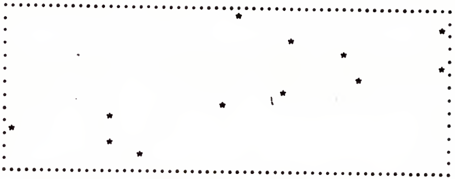


```
MSE=   0.0       RMS=   0.0       RHO=   0.0
MEAN ERR=      0.0        MEAN=      26.3569    XMAPE=       0.0
```

Figure 5.15 - Forecast: Savings and Loan Associations, Mortgage Holdings

```
                                   FINANCIAL SIMULATIONS    10/19/76
ACTUAL    SOLUTION  RESIDUALS
@FDD +     @FOD *                                    RANGE    -0.01  TO    0.13

 0.063     0.063     0.0     761
 0.130     0.130     0.0     762
 0.080     0.080     0.0     763
 0.097     0.097     0.0     764
 0.131     0.131     0.0     771
 0.104     0.104     0.0     772
 0.076     0.076     0.0     773
 0.057     0.057     0.0     774
 0.020     0.020     0.0     781
-0.014    -0.014     0.0     782
 0.020     0.020     0.0     783
 0.030     0.030     0.0     784
```

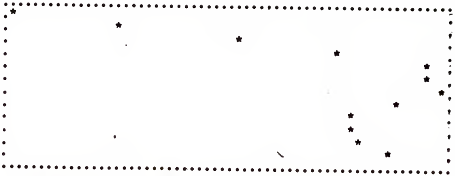


```
MSE=   0.0       RMS=   0.0       RHO=   0.0
MEAN ERR=     0.0       MEAN=      0.0661     XMAPE=      0.0
```

Figure 5.16 - Forecast: Commercial Banks, Demand Deposit Flows

```
                              FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS
 @FDT +    @FDT *                                      RANGE     0.41  TO     0.86

0.409     0.409      0.0     761
0.523     0.523      0.0     762
0.648     0.648      0.0     763
0.755     0.755      0.0     764
0.847     0.847      0.0     771
0.849     0.849      0.0     772
0.862     0.862      0.0     773
0.813     0.813      0.0     774
0.767     0.767      0.0     781
0.765     0.765      0.0     782
0.772     0.772      0.0     783
0.808     0.808      0.0     784
```

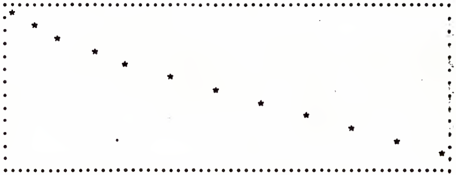


```
     MSE=   0.0       RMS=   0.0       RHO=   0.0
     MEAN ERR=     0.0       MEAN=      0.7348    XMAPE=      0.0
```

Figure 5.17 - Forecast: Commercial Banks, Time Deposit Flows

```
                         FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                             RANGE     4.50  TO     6.54
 FMTGB+    FMTGB*

 4.502     4.502     0.0     761
 4.609     4.609     0.0     762
 4.734     4.734     0.0     763
 4.883     4.883     0.0     764
 5.055     5.055     0.0     771
 5.241     5.241     0.0     772
 5.450     5.450     0.0     773
 5.665     5.665     0.0     774
 5.884     5.884     0.0     781
 6.105     6.105     0.0     782
 6.322     6.322     0.0     783
 6.536     6.536     0.0     784
```

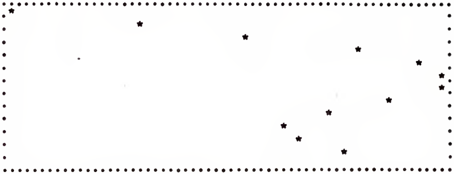


```
MSE=   0.0        RMS=   0.0        RHO=   0.0
MEAN ERR=      0.0       MEAN=      5.4157     XMAPE=       0.0
```

Figure 5.18 - Forecast: Commercial Banks, Mortgage Holdings

```
                                    FINANCIAL SIMULATIONS    10/19/76
ACTUAL   SOLUTION  RESIDUALS                                  RANGE     0.38  TO     0.52
 CSS  +    CSS  *

 0.379    0.379    0.0     761
 0.422    0.422    0.0     762
 0.458    0.458    0.0     763
 0.496    0.496    0.0     764
 0.518    0.518    0.0     771
 0.525    0.525    0.0     772
 0.523    0.523    0.0     773
 0.508    0.508    0.0     774
 0.486    0.486    0.0     781
 0.472    0.472    0.0     782
 0.476    0.476    0.0     783
 0.491    0.491    0.0     784
```



```
MSE=    0.0        RMS=    0.0       RHO=   0.0
MEAN ERR=      0.0        MEAN=       0.4795     XMAPE=       0.0
```

Figure 5.19 - Forecast: Private Residential Construction (Single-Family)

In view of the model's performance during the sample period, it is not surprising that the forecasts for all of the endogenous variables looked reasonable. Therefore, only the major variables of interest, S&L deposits and mortgages, commercial bank deposits and mortgages, and residential construction are examined in detail.

For savings and loan associations, actual data are available for 76:1 and 76:2. The mean absolute percent forecast error (XMAPE) for deposits is .8 percent and XMAPE for mortgages is .2 percent.

For banks, actual data are only available for deposits. Calculated for the first two quarters, XMAPE for demand deposits is 1.1 percent and for time deposits it is 1.5 percent.

Finally, for residential construction, only first quarter data are available. The forecast error is 4.1 percent.

This forecasting experiment strongly confirms the result derived from the historical simulation that all of the financial equations, as well as the construction equation, meet rather high performance standards. Thus, one can be reasonably assured that the developed model produces much more accurate forecasts of regional housing activity than have been available so far.

5.5 Summary and Conclusions

The focus of this chapter has been on estimating and evaluating a simultaneous equation model of deposit flows, mortgage lending, and residential construction in the State of Florida, with emphasis on asserting the link between regional financial and real activity.

Since the theory of household liquid asset demand and the theory of portfolio behavior of financial intermediaries had already been developed in earlier chapters, the first part of chapter 5 was devoted to a theoretical analysis of the short-run determinants of residential construction.

While data problems prevented many of the postulated determinants from being statistically significant in the estimated model, regional financial variables were found to have very high explanatory power in the construction equation. Dynamic simulations confirmed the estimation results and conveyed a generally very favorable impression of the model's dynamic characteristics and its forecasting ability.

In a fully simultaneous regional econometric model, the inclusion of a financial sector will not only result in an improved forecasting performance in the construction sector, but it will very directly affect other variables as well, in particular state personal income. Thus, it was not only important to assert the link between financial and real but of equal importance was a demonstration that financial variables themselves can in fact be forecasted with high accuracy. The study appears to have met both objectives.

Further research should prove to be useful in three major problem areas. First, it would be interesting to determine the causes for the regional differences in the interest sensitivity of depositors. In particular, the separate effects of such factors as different bank branching laws, average deposit size, the degree of competition between savings and loan associations and commercial banks, and advertising expenditure should be assessed. Second, the Federal Home Loan Bank System lending behavior at the district bank level and its regional impact warrants further analysis. With the cooperation of the various district banks, it should be possible to construct the required interest rate series. Third, housing starts equations should be estimated at the SMSA level. It may be expected that this further disaggregation increases the explanatory power of demographic and vacancy rate variables which should prove to be beneficial for policy analysis.

5.6 Estimated Coefficients, Notes, and Variable Definitions

5.6.1 Estimated Coefficients

$$\Delta \text{S1/YPF} = -\underset{(3.6)}{.1623}*(\text{S1}(-1)/\text{YPF}) - \underset{(11.5)}{.00456}*\text{RTB}(-1)$$

$$+ \underset{(5.2)}{.00136}*\text{TIME} + \underset{(6.3)}{.0628}$$

$R^2 = .87$ SE = .00277 OLS

mean ΔS1/YPF = .0153 mean S1/YPF = .364

$$\text{S2A} = \underset{(4.0)}{.4200}*\Delta\text{S1ADJ} + \underset{(7.0)}{.4115}*\text{S1ADJ}(-1) - \underset{(7.6)}{.4337}*\text{S2}(-1)$$

$$+ \underset{(11.3)}{.7323}*\text{S4}(-1) + \underset{(7.0)}{.4041}$$

where: S2A = S2 - S2(-1) + S5

$R^2 = .97$ DW = 1.91 SE = .0629 $\rho = .35$ TSCORC

mean S2A = .816 mean S2 = 12.29

$$\text{S3} = \underset{(1.3)}{.1843}*\text{S3}(-1) + \underset{(2.2)}{.00236}*(\text{S3SYS}*\text{S1}) + \underset{(5.2)}{.1674}*\text{S2}(-1)$$

$$- \underset{(3.8)}{.1583}*\text{S1ADJ}(-1) - \underset{(1.4)}{.1575}*\Delta\text{S1ADJ} - \underset{(1.5)}{.0908}$$

$R^2 = .99$ SE = .0405 TSLS

mean S3 = .457

$$\mathrm{S4} = \underset{(7.5)}{.7802*\mathrm{S4}(-1)} + \underset{(1.8)}{1.762*\mathrm{S5}} + \underset{(1.8)}{.25830*\Delta \mathrm{S1ADJ}}$$

$$+ \underset{(2.2)}{.00833*(\mathrm{RMTG}*\mathrm{S1ADJ}(-1))} - \underset{(3.5)}{.0171(\mathrm{RFHL}*\mathrm{S1ADJ}(-1))}$$

$$+ \underset{(3.0)}{.0048*(\mathrm{RTB}(-2)*\mathrm{S1ADJ}(-1))} - \underset{(1.6)}{.197}$$

$R^2 = .99$ SE = .0509 TSLS

mean S4 = .849

$$\mathrm{S5} = \underset{(16.2)}{.01368*\mathrm{S2}(-1)} + \underset{(14.2)}{.20996*\Delta \mathrm{S2}}$$

$$- \underset{(2.5)}{.00050*((3*\mathrm{RMTG}-\mathrm{RMTG}(-2)-\mathrm{RMTG}(-3)-\mathrm{RMTG}(-4))*\mathrm{S2}(-1))}$$

$$+ \underset{(7.8)}{.0704}$$

$R^2 = .98$ DW = 1.67 SE = .0156 TSLS

mean S5 = .330

$$\Delta \mathrm{FDD} = - \underset{(2.9)}{.5188*\mathrm{FDD}(-1)} - \underset{(2.9)}{.00159*(\mathrm{RTB}(-1)*\mathrm{YPF})}$$

$$- \underset{(1.3)}{.00908*(\mathrm{RTD}*\mathrm{YPF})} - \underset{(3.2)}{.1120*(\mathrm{PC}*\mathrm{YPF})}$$

$$+ \underset{(3.5)}{.3298*\mathrm{YPF}} - \underset{(3.0)}{1.011}$$

$R^2 = .71$ SE = .109 $\rho = -.13$ CORC

mean FDD = 8.22

$$\begin{aligned}\Delta FDT = {} & -\underset{(1.7)}{.1628}*FDT(-1) - \underset{(3.0)}{.00160}*(RTB*YPF) \\ & + \underset{(3.4)}{.0317}*(RTD*YPF) - \underset{(4.1)}{.0454}*(RSL*YPF) \\ & + \underset{(7.3)}{.2038}*YPF - \underset{(6.4)}{1.599}\end{aligned}$$

$R^2 = .78$ $SE = .103$ OLS

mean $FDT = 9.49$

$$\begin{aligned}FMTGB = {} & \underset{(7.1)}{.6963}*FMTGB(-1) + \underset{(3.1)}{.0789}*(FDD(-1)+FDT(-1)) \\ & + \underset{(1.3)}{.1043}*\Delta FDT - \underset{(2.5)}{.4666}\end{aligned}$$

$R^2 = .9985$ $SE = .0489$ $\rho = .63$ CORC

mean $FMTGB = 2.78$

$$\begin{aligned}CSS = {} & \underset{(5.7)}{.1986}*\Delta S4 + \underset{(10.6)}{.2669}*(.6*\Delta S2+.4*\Delta S2(-1)) \\ & + \underset{(3.6)}{.2326}*\Delta FMTGB + \underset{(16.7)}{.1373}\end{aligned}$$

$R^2 = .96$ $DW = 2.24$ $SE = .0187$ OLS

mean $CSS = .297$

5.6.2 Notes and Variable Definitions

- Sample = 1969:1 - 1975:4

- Dollar magnitudes are measured in billions of current dollars and are seasonally adjusted;
  Interest rates are measured in percentage points;
  All flows are at quarterly rates.

- The absolute values of t-statistics are shown in parentheses.

- ρ is the coefficient of serial correlation for those equations estimated with the iterative procedure of Cochrane and Orcutt (CORC) or the corresponding procedure (Fair 1972) for two-stage least squares regressions (TSCORC).

- Variable Definitions:

CSS	Value of single-family construction put in place
FDD	Demand deposits, Florida commercial banks
FDT	Time deposits, Florida commercial banks
FMTGB	Mortgage holdings, Florida commercial banks
PC	Implicit price deflator, personal consumption expenditure
RFHL	Rate charged on FHLB advances
RMTG	Effective conventional mortgage rate
RSL	Rate on S&L deposits
RTB	Three-month Treasury bill rate
RTD	Rate on commercial bank time deposits
S1	Deposits, Florida S&Ls
S1ADJ	S1 * (1-minimum liquidity ratio required of FHLB System members)
S2	Mortgage holdings, Florida S&Ls
S3	FHLB advances, Florida S&Ls
S3SYS	FHLB advances, U.S.
S4	Mortgage commitments outstanding, Florida S&Ls
S5	Mortgage repayments, Florida S&Ls
TIME	Time trend; 1966:1 = 1, 1966:2 = 2, etc.
YPF	Personal income, Florida

- Data Sources

Bank data:	_Dimensions_, various issues. _Assets and Liabilities, Commercial and Mutual Savings Banks_, various issues.

Savings and loan data: Federal Home Loan Bank of Atlanta

Interest rates: *Federal Reserve Bulletin*, various issues

State personal income: U.S. Department of Commerce, Bureau of Economic Analysis

Construction data: *F.W. Dodge Florida Construction Statistics*

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